UTAH

State Implementation Plan

Control Measures for Area and Point Sources, Fine Particulate Matter,

$PM_{2.5}$ SIP for the Salt Lake City, UT Nonattainment Area

Section IX. Part A.21

Adopted by the Utah Air Quality Board

December 04, 2013

Acronyms

BACT	Best Available Control Technology
CAA	Clean Air Act
CFR	Code of Federal Regulations
CMAQ	Community Multiscale Air Quality
CTG	Control Techniques Guideline Documents
DAQ	Utah Division of Air Quality (also UDAQ)
EPA	Environmental Protection Agency
FRM	Federal Reference Method
MACT	Maximum Available Control Technology
MATS	Model Attainment Test Software
MPO	Metropolitan Planning Organization
$\mu g/m^3$	Micrograms Per Cubic Meter
Micron	One Millionth of a Meter
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NH_3	Ammonia
NO_x	Nitrogen Oxides
NSPS	New Source Performance Standard
NSR	New Source Review
PM	Particulate Matter
PM_{10}	Particulate Matter Smaller Than 10 Microns in Diameter
$PM_{2.5}$	Particulate Matter Smaller Than 2.5 Microns in Diameter

RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernal Emissions
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
TSD	Technical Support Document
VOC	Volatile Organic Compounds
UAC	Utah Administrative Code
WRF	Weather Research and Forecasting

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Chapter 1 – INTRODUCTION AND BACKGROUND

1.1 Fine Particulate Matter

According to EPA's website, particulate matter, or PM, is a complex mixture of extremely small particles and liquid droplets. Particulate matter is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Other negative effects are reduced visibility and accelerated deterioration of buildings.

EPA groups particle pollution into two categories:

- "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. Utah has previously addressed inhalable coarse particles as part of its PM_{10} SIPs for Salt Lake and Utah Counties, but this fraction is not measured as $PM_{2.5}$ and will not be a subject for this nonattainment SIP.

- "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller and thus denoted as $PM_{2.5}$. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

PM concentration is reported in micrograms per cubic meter or $\mu g/m^3$. The particulate is collected on a filter and weighed. This weight is combined with the known amount of air that passed through the filter to determine the concentration in the air.

1.2 Health and Welfare Impacts of $PM_{2.5}$

Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example;
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;
- nonfatal heart attacks; and
- pre-mature death in people with heart or lung disease.

People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even healthy people may experience temporary symptoms from exposure to elevated levels of particle pollution.

1.3 Fine Particulate Matter in Utah

Excluding wind-blown desert dust events, wild land fires, and holiday related fireworks, elevated $PM_{2.5}$ in Utah occurs when stagnant cold pools develop during the winter season.

The synoptic conditions that lead to the formation of cold pools in Utah's nonattainment areas are: synoptic scale ridging, subsidence, light winds, snow cover (often), and cool- to-cold surface temperatures. These conditions occur during winter months, generally mid-November through early March.

During a winter-time cold pool episode, emissions of $PM_{2.5}$ precursors react quickly to elevate overall concentrations, and of course dispersion is very poor due to the very stable air mass. Episodes may last from a few days to tens of days when meteorological conditions change to once again allow for good mixing.

The scenario described above leads to exceedances and violations of the 24-hour health standard for $PM_{2.5}$. In other parts of the year concentrations are generally low, and even with the high peaks incurred during winter, are well within the annual health standard for $PM_{2.5}$.

1.4 2006 NAAQS for $PM_{2.5}$

In September of 2006, EPA revised the (1997) standards for $PM_{2.5}$. While the annual standard remained unchanged at 15 µg/m^3, the 24-hr standard was lowered from 65 µg/m^3 to 35 µg/m^3.

DAQ has monitored $PM_{2.5}$ since 2000, and found that all areas within the state have been in compliance with the 1997 standards. At this new 2006 level, all or parts of five counties have collected monitoring data that is not in compliance with the 24-hr standard.

In 2013, EPA lowered the annual average to 12 µg/m^3. Monitoring data shows no instances of noncompliance with this revised standard.

1.5 $PM_{2.5}$ Nonattainment Areas in Utah

There are two distinct nonattainment areas for the 2006 $PM_{2.5}$ standards residing entirely within the state of Utah. These are the Salt Lake City, UT, and Provo, UT nonattainment areas, which together encompass what is referred to as the Wasatch Front. A third nonattainment area is more or less geographically defined by the Cache Valley which straddles the border between Utah and Idaho (the Logan, UT – ID nonattainment area.) Figure 1.1 below shows the geographic extent of these areas.

None of these three areas has violated the annual NAAQS for $PM_{2.5}$. Without exception, the exceedances leading to 24-hr NAAQS violations are associated with relatively short-term meteorological occurrences.

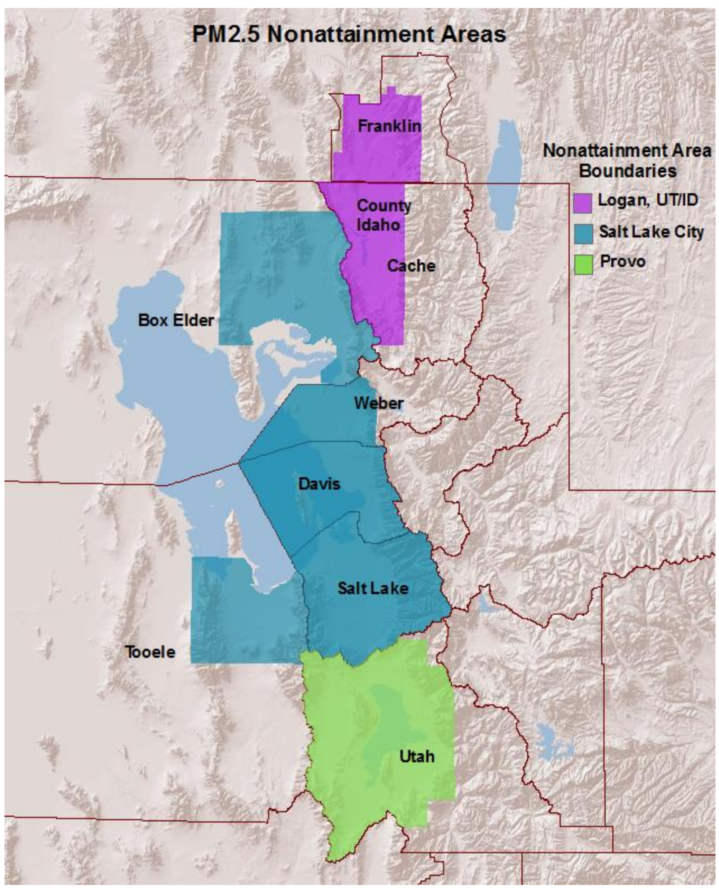


Figure 1.1, Nonattainment Areas for the 2006 $PM_{2.5}$ NAAQS

Each of these three areas was designated, by the EPA, based on the weight of evidence of the following nine factors recommended in its guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

EPA also used analytical tools and data such as pollution roses, fine particulate composition monitoring data, back trajectory analyses, and the contributing emission score (CES) to evaluate these areas.

While the general meteorological characteristics are identical between the Wasatch Front and Cache Valley, there are two important differences related to topography. First, the Cache Valley is a closed basin while the Wasatch Front has many large outlets that connect it to the larger Great Basin. The large outlets along the Wasatch Front provide the potential for greater advection of pollutants and for a potentially weaker cold pool. Second, the Cache Valley is a narrow (<20 km) valley bordered by extremely steep mountains. These topographical differences lead to faster forming, more intense, and more persistent cold pools in Cache Valley relative to the Wasatch Front.

Because of these differences, the two Wasatch Front areas and the Cache Valley are designated as separate nonattainment areas; however, they will all be modeled together within the same modeling domain.

1.6 $PM_{2.5}$ Attainment Plan Precursors

The majority of ambient $PM_{2.5}$ collected during a typical cold-pool episode of elevated concentration is secondary particulate matter, born of precursor emissions. The main precursor gasses associated with fine particulate matter are discussed in EPA's Clean Air Particulate Implementation Rule (FR 72, 20586), and there are certain presumptions about each of these concerning how they are to be treated in a given attainment plan. It is important that this plan identify which of these will be evaluated for the purpose of developing control measures.

- Sulfur Dioxide (SO_2) is to be evaluated for control measures in all nonattainment areas. SO_2 is therefore to be considered as a $PM_{2.5}$ attainment plan precursor.

- Oxides of Nitrogen (NO_x) are presumed to be evaluated for control measures in any given nonattainment area, unless it can be demonstrated that it is not a significant contributor to $PM_{2.5}$ concentrations. No such demonstration will be made as part of this plan. Therefore, NO_x will be considered as a $PM_{2.5}$ attainment plan precursor.

- Volatile Organic Compounds (VOC) are presumed not to be evaluated for control measures in any given nonattainment area, unless it can be demonstrated that it is in fact a significant contributor to $PM_{2.5}$ concentrations. The air modeling that underlies this SIP demonstration does in fact indicate that $PM_{2.5}$ concentrations are very sensitive to VOC concentrations. As such, VOC is to be considered a significant contributor to $PM_{2.5}$ concentrations and will be considered as a $PM_{2.5}$ attainment plan precursor. Additional information concerning a demonstration to this effect is included in the Technical Support Document.

1.7 Other $PM_{2.5}$ Precursors – Ammonia

Ammonia (NH_3) is another precursor gas associated with fine particulate matter. Like VOC, the Clean Air Particulate Implementation Rule presumes that ammonia would not be evaluated for control measures in any given nonattainment area, unless it can be demonstrated that it is in fact a significant contributor to $PM_{2.5}$ concentrations. Most of the secondary particulate matter collected during cold-pool conditions is ammonium nitrate. Still, there is every indication that in each of the airsheds evaluated with the air model there is a large surplus of ammonia relative to what would be required to produce the observed ammonium nitrate. Sensitivity runs with the model indicate that significant reductions in the inventories of ammonia have little to no effect on predicted $PM_{2.5}$ concentrations. Because the modeled cuts in ammonia emissions were well beyond what might be considered as reasonable or even best controls, ammonia will not be identified as a $PM_{2.5}$ attainment plan precursor.

Chapter 2 – REQUIREMENTS FOR 2006 $PM_{2.5}$ PLAN REVISIONS

2.1 Requirements for Nonattainment SIPs

Section 110 of the Clean Air Act lists the requirements for implementation plans. Many of these requirements speak to the administration of an air program in general. Section 172 of the Act contains the plan requirements for nonattainment areas. Some of the more notable requirements identified in these sections of the Act that pertain to this SIP include:

- Implementation of Reasonably Available Control Measures (RACM) as expeditiously as practicable
- Reasonable Further Progress (RFP) toward attainment of the National Ambient Air Quality Standards by the applicable attainment date
- Enforceable emission limits as well as schedules for compliance
- A comprehensive inventory of actual emissions
- Contingency measures to be undertaken if the area fails to make reasonable further progress or attain the NAAQS by the applicable attainment date

More specific requirements for the preparation, adoption, and submittal of implementation plans are specified in 40 CFR Part 51. Subpart Z of Part 51 contains provisions for Implementation of $PM_{2.5}$ National Ambient Air Quality Standards.

2.2 $PM_{2.5}$ Implementation Rule

Beyond what has been codified in Subpart Z of Part 51 concerning the Implementation of the $PM_{2.5}$ NAAQS, EPA provides additional clarification and guidance in its Clean Air Particulate Implementation Rule for the 1997 $PM_{2.5}$ NAAQS (FR 72, 20586) and its subsequent Implementation Guidance for the 2006 24-Hour Fine Particle NAAQS (March 2, 2012).

2.3 Summary of this SIP Proposal

This implementation plan was developed to meet the requirements specified in the law, rule, and appropriate guidance documents identified above. Discussed in the following chapters are: air monitoring, reasonably available control measures, modeled attainment demonstration, emission inventories, reasonable further progress toward attainment, and contingency measures. Additional information is provided in the technical support document.

Chapter 3 – Ambient Air Quality Data

3.1 Measuring Fine Particle Pollution in the Atmosphere

Utah has monitored $PM_{2.5}$ in its airsheds since 2000 following the promulgation of the 1997 $PM_{2.5}$ NAAQS which was set at 65 µg/m^3. $PM_{2.5}$ monitoring sites were initially located based on concentrations of PM_{10}, which historically were measured at sites located based on emissions of primary particles. $PM_{2.5}$ concentrations, especially during Utah's wintertime valley temperature inversions, tend to be distributed more homogenously within a specific airshed. Homogeneity of $PM_{2.5}$ concentrations means that one or two monitors are adequate to determine compliance with the NAAQS in specific airsheds. DAQ's monitors are appropriately located to assess concentration, trends, and changes in $PM_{2.5}$ concentrations. During Utah's wintertime cold-pool episodes, every day sampling and real time monitoring are needed for modeling and public notification.

3.2 Utah's Air Monitoring Network

The Air Monitoring Center (AMC) maintains an ambient air monitoring network in Utah that collects both air quality and meteorological data. Figure 3.1 shows the location of sites along the Wasatch Front that collect $PM_{2.5}$ data. Twelve sites collect $PM_{2.5}$ data using the Federal Reference Method (FRM); $PM_{2.5}$ is collected on filters over a 24 hour period and its mass is measured gravimetrically. Seven of those sites also measure $PM_{2.5}$ concentrations continuously in real-time. Real-time $PM_{2.5}$ data is useful both for pollution forecasting and to compare with 24-hour concentrations of $PM_{2.5}$ collected on filters. Of the twelve sites that use the FRM to measure $PM_{2.5}$, six sites collect $PM_{2.5}$ data daily and six sites collect $PM_{2.5}$ data on every third day. Three sites along the Wasatch Front collect speciated $PM_{2.5}$; the particulate matter on the speciated $PM_{2.5}$ filters is analyzed for organic and inorganic carbon and a list of 48 elements. $PM_{2.5}$ speciation data is particularly useful in helping to identify sources of particulate matter. The ambient air quality monitoring network along Utah's Wasatch Front meets EPA requirements for monitoring networks.

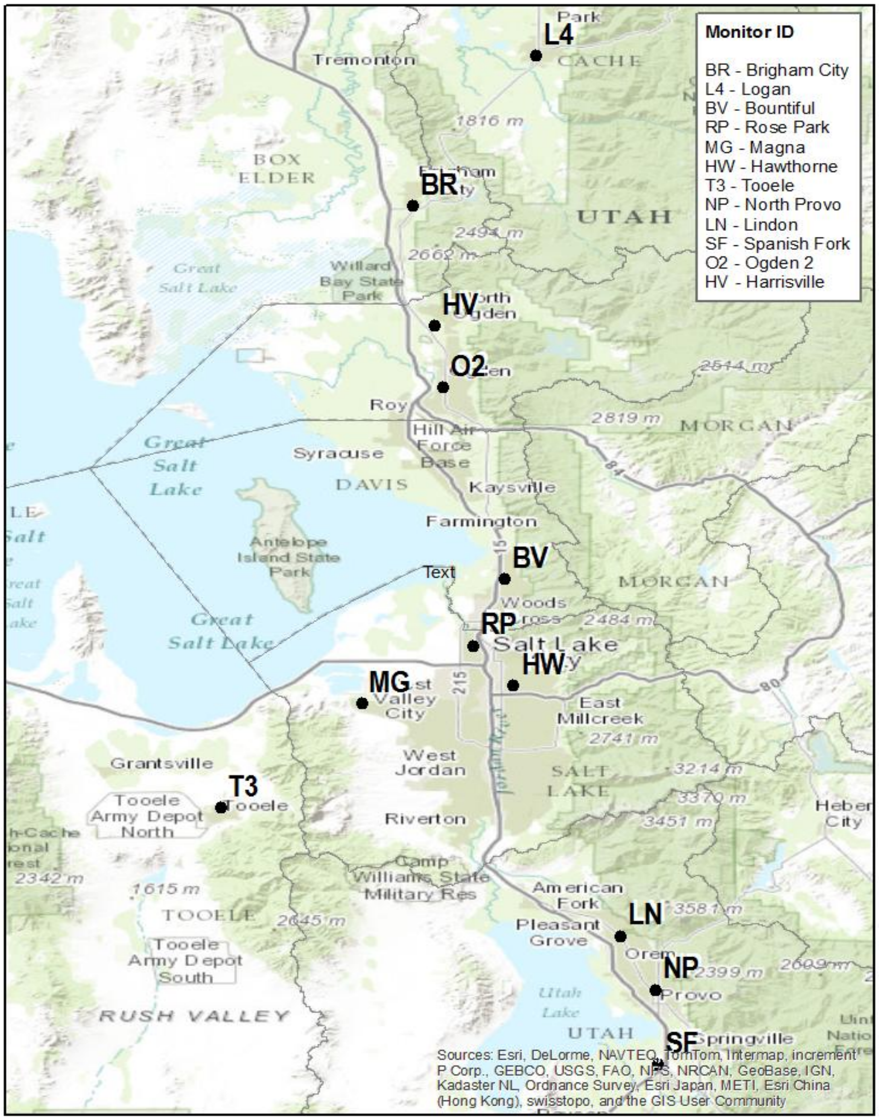


Figure 3.1, Utah's $PM_{2.5}$ Air Monitoring Network

3.3 Annual $PM_{2.5}$ – Mean Concentrations

The procedure for evaluating $PM_{2.5}$ data with respect to the NAAQS is specified in Appendix N to 40 CFR Part 50. Generally speaking, the annual $PM_{2.5}$ standard is met when a three-year average of annual mean values is less than or equal to 12.0 µg/m^3. Each annual mean is itself an average of four quarterly averages.

Table 3.1, below shows the running 3-year averages of annual mean values for each of the monitoring locations along the Wasatch Front. It can be seen from the data that there are no locations at which the annual NAAQS has been violated.

		3-Year Average of Annual Mean Concentrations		
Location	**County**	**08 - 10**	**09 - 11**	**10 - 12**
Brigham City	Box Elder	8.3	8.2	7.7
Ogden 2 (POC 1)	Weber	9.7	9.5	9.1
Harrisville	Weber	8.6	8.3	7.6
Bountiful	Davis	9.8	9.2	8.3
Rose Park (POC 1)	Salt Lake	10.4	9.7	9.2
Magna	Salt Lake	8.5	8.4	7.7
Hawthorn (POC 1)	Salt Lake	10.4	9.7	8.8
Tooele	Tooele	6.8	6.8	6.3
Lindon (POC 1)	Utah	9.8	9.1	8.3
North Provo	Utah	9.4	8.7	8.1
Spanish Fork	Utah	8.8	8.5	7.7

Table 3.1, $PM_{2.5}$ Annual Mean Concentrations

3.4 Daily $PM_{2.5}$ – Averages of 98th Percentiles and Design Values

The procedure for evaluating $PM_{2.5}$ data with respect to the NAAQS is specified in Appendix N to 40 CFR Part 50. Generally speaking, the 24-hr. $PM_{2.5}$ standard is met when a three-year average of 98th percentile values is less than or equal to 35 µg/m^3. Each year's 98th percentile is the daily value below which 98% of all daily values fall.

Table 3.2, below shows the running 3-year averages of 98th percentile values for each of the monitoring locations along the Wasatch Front. It can be seen from the data that there are many locations at which the 24-hr. NAAQS has been violated, and this SIP has been structured to specifically address the 24-hr. standard.

Site-Specific Baseline Design Values:		3-Year Average of 98th Percentiles			Baseline Design Value
Location	County	08 - 10	09 - 11	10 - 12	
Brigham City	Box Elder	42	40	37	**39.9**
Ogden 2 (POC 1)	Weber	37	41	37	**38.5**
Harrisville	Weber	36	37	33	**35.1**
Bountiful	Davis	38	40	34	**37.5**
Rose Park (POC 1)	Salt Lake	41	41	35	**39.0**
Magna	Salt Lake	33	35	30	**32.5**
Hawthorn (POC 1)	Salt Lake	44	45	38	**42.1**
Tooele	Tooele	26	27	24	**25.8**
Lindon (POC 1)	Utah	41	41	32	**37.9**
North Provo	Utah	36	35	29	**33.4**
Spanish Fork	Utah	39	42	35	**38.5**

Table 3.2, 24-hour $PM_{2.5}$ Monitored Design Values

As mentioned in the foregoing paragraph, this SIP is structured to address the 24-hr. $PM_{2.5}$ NAAQS. As such the modeled attainment test must consider monitored baseline design values from each of these locations. EPA's modeling guidance[1] recommends this be calculated using three-year averages of the 98th percentile values. To calculate the monitored baseline design value, EPA recommends an average of three such three-year averages that straddle the baseline inventory. 2010 is the year represented by the baseline inventory. Therefore, the three-year average of 98th percentile values collected from 2008-2010 would be averaged together with the three-year averages for 2009-2011 and 2010-2012 to arrive at the site-specific monitored baseline design values. These values are also shown in Table 3.2.

3.5 Composition of Fine Particle Pollution – Speciated Monitoring Data

DAQ operates three $PM_{2.5}$ speciation sites. The Hawthorne site in Salt Lake County is one of 54 Speciation Trends Network (STN) sites operated nationwide on an every-third-day sampling schedule. Sites at Bountiful/Viewmont in Davis County and Lindon in Utah County are State and Local Air Monitoring Stations (SLAMS) $PM_{2.5}$ speciation sites that operate on an every-sixth-day sampling schedule.

Filters are prepared by the EPA contract laboratory and shipped to Utah for sampling. Samples are collected for particulate mass, elemental analysis, identification of major cations and anions, and concentrations of elemental and organic carbon as well as crustal material present in $PM_{2.5}$. Carbon

[1] Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze (EPA -454B-07-002, April 2007)

sampling and analysis changed in 2007 to match the Interagency Monitoring of Protected Visual Environments (IMPROVE) method using a modified IMPROVE sampler at all sites.

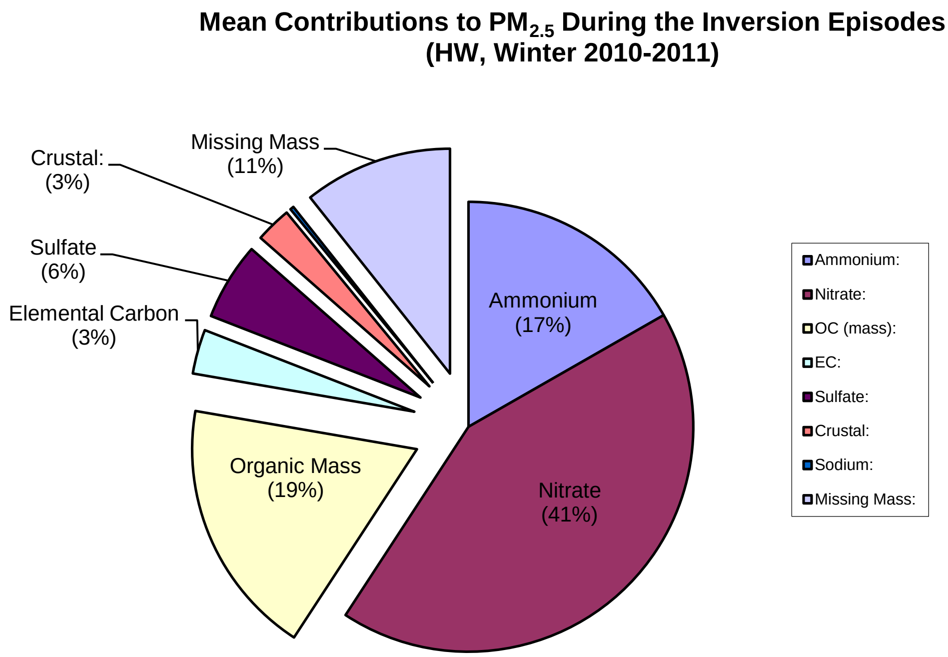
The $PM_{2.5}$ is collected on three types of filters: Teflon, nylon, and quartz. Teflon filters are used to characterize the inorganic contents of $PM_{2.5}$. Nylon filters are used to quantify the amount of ammonium nitrate, and quartz filters are used to quantify the organic and inorganic carbon content in the ambient $PM_{2.5}$.

Data from the speciation network show the importance of volatile secondary particulates during the colder months. These particles are significantly lost in FRM $PM_{2.5}$ sampling.

During the winter periods between 2009 and 2011, DAQ conducted special winter speciation studies aimed at better characterization of $PM_{2.5}$ during the high pollution episodes. These studies were accomplished by shifting the sampling of the Chemical Speciation Network monitors to 1-in-2-day schedule during the months of January and February. Speciation monitoring during the winter high-pollution episodes produced similar results in $PM_{2.5}$ composition each year.

The results of the speciation studies lead to the conclusion that the exceedances of the $PM_{2.5}$ NAAQS are a result of the increased portion of the secondary $PM_{2.5}$ that was chemically formed in the air and not primary $PM_{2.5}$ emitted directly into the troposphere.

Figure 3.2 below shows the contribution of the identified compounds from the speciation sampler both during a winter temperature inversion period and during a well-mixed winter period.



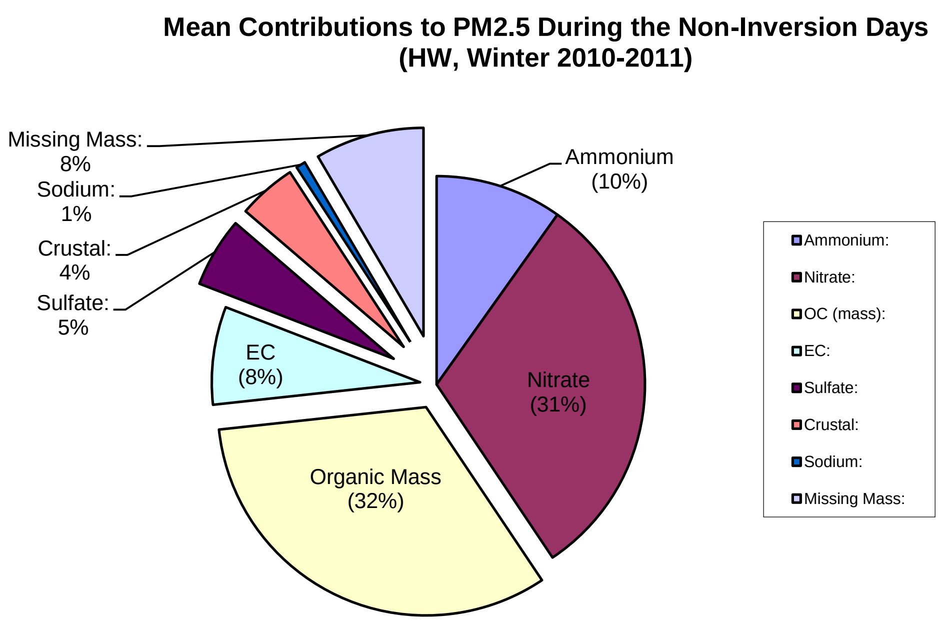


Figure 3.2, Composite Wintertime $PM_{2.5}$ Speciation Profiles

3.6 PCAP Study

The Persistent Cold Air Pooling Study (PCAPS) is an ongoing National Science Foundation-funded project conducted by the University of Utah to investigate the processes leading to the formation, maintenance and destruction of persistent temperature inversions in Salt Lake Valley. Field work for the project was conducted in the winter of 2010-2011 and focused on the meteorological dynamics of temperature inversions in the Salt Lake Valley and in the Bingham Canyon pit mine in the southwest corner of Salt Lake Valley. In addition to identifying key meteorological processes involved in the dynamics of temperature inversions in Salt Lake Valley, the other primary objectives of PCAPS is to determine how persistent temperature inversions affect air pollution transport and diffusion in urban basins and to develop more accurate meteorological models describing the formation, persistence and dispersion of temperature inversions in Salt Lake Valley.

Analyses of most data sets collected during the PCAPS are still underway. However, one study examining $PM_{2.5}$ concentrations along an elevation gradient north of Salt Lake City (1300-1750 meters) showed that $PM_{2.5}$ concentrations generally decreased with altitude and increased with time during a single temperature inversion event.[1] Final results from PCAPS will help DAQ understand both how persistent temperature inversions affect $PM_{2.5}$ concentrations along the Wasatch Front and will enhance DAQ's ability to accurately forecast the formation and breakup of temperature inversion that lead to poor wintertime air quality.

3.7 Ammonia (NH_3) Studies

The Division of Air Quality deployed an ammonia monitor as a part of the special winter study for 2009. A URG 9000 instrument was used to record hourly values of ambient ammonia between the months of December and February.

The resulting measurements showed that the ambient concentration of ammonia tended to be generally an order of magnitude higher than those of nitric acid: 12-17 ppbv and 1-2 ppbv, respectively.

Unfortunately, the use of the instrument proved to be excessively labor intensive due to the high frequency of calibrations and corrections for drift. The data obtained during the winter of 2009, albeit valuable for rough estimation of the ambient ammonia concentrations, contained an abnormal amount of error for accurate mechanistic analysis.

[1] Silcox, G.D., K.E. Kelly, E.T. Crosman, C.D. Whiteman, and B.L. Allen, 2012: Wintertime $PM_{2.5}$ concentrations in Utah's Salt Lake Valley during persistent multi-day cold air pools. Atmospheric Environment, **46**, 17-24.

Chapter 4 – EMISSION INVENTORY DATA

4.1 Introduction

The emissions inventory is one means used by the state to assess the level of pollutants and precursors released into the air from various sources. The methods by which emissions inventories are collected and calculated are constantly improving in response to better analysis and more comprehensive rules. The inventories underlying this SIP were compiled using the best information available.

The sources of emissions that were inventoried may be discussed as belonging to four general categories: industrial point sources; on-road mobile sources; off-road mobile sources; and area sources which represent a collection of smaller, more numerous point sources, residential activities such a home heating, and in some cases biogenic emissions.

This SIP is concerned with $PM_{2.5}$, both primary in its origin and secondary, referring to its formation removed in time and space from the point of origin for certain precursor gasses. Hence, the pollutants of concern, at least for inventory development purposes, included $PM_{2.5}$, SO_2, NO_x, VOC, and NH_3.

On-road mobile sources are inventoried using EPA's MOVES model, in conjunction with information generated by travel demand models such as vehicle speeds and miles traveled. The inventory information is calculated in units of tons per day, adjusted for winter conditions. Emissions from the other three categories are calculated in terms of tons per year.

Prior to use in the air quality model, the emissions are pre-processed to account for the seasonality of Utah's difficulty with secondary $PM_{2.5}$ formation during winter months. These temporal adjustments also account for daily and weekly activity patterns that affect the generation of these emissions.

To acknowledge the episodic and seasonal nature of Utah's elevated $PM_{2.5}$ concentrations, inventory information presented herein is, unless otherwise noted, a reflection of the temporal adjustments made prior to air quality modeling. This makes more appropriate the use of these inventories for such purposes as correlation with measured $PM_{2.5}$ concentrations, control strategy evaluation, establishing budgets for transportation conformity, and tracking rates of progress.

There are various time horizons that are significant to the development of this SIP. It is first necessary to look at past episodes of elevated $PM_{2.5}$ concentrations in order to develop the air quality model. The episodes studied as part of the SIP occurred in 2007, 2008, 2009, and 2010. It is then necessary to look several years into the future when developing emission control strategies. The significant time horizons relate to the statutory attainment dates associated with the 2006 $PM_{2.5}$ NAAQS. These dates may range from 2014 to 2019. Such projections are made as comparisons to a baseline inventory that is contemporaneous with the monitored design values discussed in Section 3.4. This baseline is represented by the year 2010. Inventories must be prepared to evaluate all of these time horizons.

4.2 The 2008 Emissions Inventory

The forgoing paragraph identified numerous points in time for which an understanding of emissions to the air is important to plan development. The basis for each of these assessments was the 2008 tri-annual inventory. This inventory represented, at the time it was selected for use, the most recent comprehensive inventory compiled by UDAQ. In addition to the large major point sources that are required to report emissions every year, the tri-annual inventories consider emissions from many more, smaller point sources. These inventories are collected in accordance with state and federal rules that ensure proper methods and comprehensive quality assurance.

Thus, to develop other inventories for each of the years discussed above, the 2008 inventory was either back-cast and adjusted for certain episodic conditions, or forecast to represent more typical conditions.

4.3 Characterization of Utah's Airsheds

As said at the outset, an emissions inventory provides a means to assess the level of pollutants and precursors released into the air from various sources. This in turn allows for an overall assessment of a particular airshed or even a comparison of one airshed to another.

The modeling analysis used to support this SIP considers a regional domain that encompasses two distinct airsheds defining the nonattainment areas along the Wasatch Front: the central Wasatch Front (Salt Lake City, UT nonattainment area), and the southern Wasatch Front (Provo, UT nonattainment area).

The inventories developed for each of these areas illustrate many similarities but also a few notable differences. They are both more or less dominated by a combination of on-road mobile and area sources. However, emissions from large point sources are more prominent in the Salt Lake City nonattainment area, where they are clustered in Salt Lake and Davis counties.

The tables presented below provide a broad overview of the emissions in the respective areas. They are organized to show the relative contributions of emissions by source category (e.g. point / area / mobile).

Table 4.1 shows the 2010 Baseline emissions in each area of the modeling domain.

2010 Baseline	NA-Area	Source Category	PM2_5	NOX	VOC	NH3	SO2
2010 Baseline Sum of Emissions (tpd)	Provo NA	Area Sources	1.86	5.56	12.77	6.53	0.28
		Mobile Sources	2.20	25.39	15.63	0.44	0.16
		NonRoad	0.31	4.40	1.71	0.00	0.09
		Point Source	0.26	0.93	0.67	0.29	0.03
		Provo NA Total	**4.64**	**36.28**	**30.79**	**7.26**	**0.56**
	Salt Lake City NA	Area Sources	5.87	17.71	51.53	17.96	0.88
		Mobile Sources	8.59	99.63	62.51	1.86	0.63
		NonRoad	1.27	23.04	9.50	0.01	0.66
		Point Source	3.89	20.14	6.48	0.64	10.64
		Salt Lake City NA Total	**19.62**	**160.51**	**130.02**	**20.47**	**12.81**
	Surrounding Areas	Area Sources	2.32	4.73	18.75	38.60	1.40
		Mobile Sources	2.98	35.37	16.02	0.45	0.17
		NonRoad	0.70	8.89	12.94	0.00	0.16
		Point Source	3.35	129.31	3.55	0.75	43.40
		Surrounding Areas Total	**9.35**	**178.30**	**51.25**	**39.81**	**45.13**
		2010 Total	**33.60**	**375.09**	**212.06**	**67.54**	**58.49**

Table 4.1, Emissions Summary for 2010 (SMOKE). Emissions are presented in tons per average winter day.

Table 4.2 is specific to the Salt Lake, UT nonattainment area, and shows emissions for the attainment year as well as any other significant milestone year. These subsequent totals include projections concerning growth in population, vehicle miles traveled, and the economy. They also include the effects of emissions control strategies that are either already promulgated or were required as part of the SIP.

Year	NA-Area	Source Category	PM2_5	NOX	VOC	NH3	SO2
2010 Baseline	**Salt Lake City NA**	Area Sources	5.87	17.71	51.53	17.96	0.88
		Mobile Sources	8.59	99.63	62.51	1.86	0.63
		NonRoad	1.27	23.04	9.50	0.01	0.66
		Point Source	3.89	20.14	6.48	0.64	10.64
		2010 Total	**19.62**	**160.51**	**130.02**	**20.47**	**12.81**
2014	**Salt Lake City NA**	Area Sources	4.74	18.18	37.33	17.68	0.89
		Mobile Sources	8.51	80.00	49.62	1.75	0.58
		NonRoad	1.02	19.70	10.05	0.01	0.56
		Point Source	4.31	22.52	7.93	0.87	8.83
		2014 Total	**18.58**	**140.41**	**104.93**	**20.31**	**10.86**
2017	**Salt Lake City NA**	Area Sources	4.66	16.97	36.02	17.57	0.89
		Mobile Sources	8.22	66.98	41.80	1.64	0.58
		NonRoad	0.82	17.13	7.55	0.01	0.25
		Point Source	4.68	23.12	8.22	0.90	9.45
		2017 Total	**18.38**	**124.20**	**93.60**	**20.12**	**11.18**
2019	**Salt Lake City NA**	Area Sources	4.49	17.76	37.09	17.15	0.90
		Mobile Sources	7.25	51.68	31.86	1.45	0.53
		NonRoad	0.82	17.28	7.10	0.01	0.62
		Point Source	4.72	25.82	9.43	1.28	8.79
		2019 Total	**17.28**	**112.54**	**85.48**	**19.88**	**10.85**

Table 4.2, Emissions Summaries for the Salt Lake City, UT Nonattainment Area; Baseline, RFP and Attainment Years (SMOKE). Emissions are presented in tons per average winter day.

The 2010 Baseline and projections to 2014, 2017 and 2019 emissions estimates are calculated from the Sparse Matrix Operator Kernel Model (SMOKE). More detailed inventory information may be found in the Technical Support Document (TSD).

Chapter 5 – ATTAINMENT DEMONSTRATION

5.1 Introduction

UDAQ conducted a technical analysis to support the development of Utah's 24-hr $PM_{2.5}$ State Implementation Plan (SIP). The analyses include preparation of emissions inventories and meteorological data, and the evaluation and application of regional photochemical model. An analysis using observational datasets will be shown to detail the chemical regimes of Utah's Nonattainment areas.

5.2 Photochemical Modeling

Photochemical models are relied upon by federal and state regulatory agencies to support their planning efforts. Used properly, models can assist policy makers in deciding which control programs are most effective in improving air quality, and meeting specific goals and objectives.

The air quality analyses were conducted with the Community Multiscale Air Quality (CMAQ) Model version 4.7.1, with emissions and meteorology inputs generated using SMOKE and WRF, respectively. CMAQ was selected because it is the open source atmospheric chemistry model co-sponsored by EPA and the National Oceanic Atmospheric Administration (NOAA), thus approved by EPA for this plan.

5.3 Domain/Grid Resolution

UDAQ selected a high resolution 4-km modeling domain to cover all of northern Utah including the portion of southern Idaho extending north of Franklin County and west to the Nevada border (Figure 5.1). This 97 x 79 horizontal grid cell domain was selected to ensure that all of the major emissions sources that have the potential to impact the nonattainment areas were included. The vertical resolution in the air quality model consists of 17 layers extending up to 15 km, with higher resolution in the boundary layer.

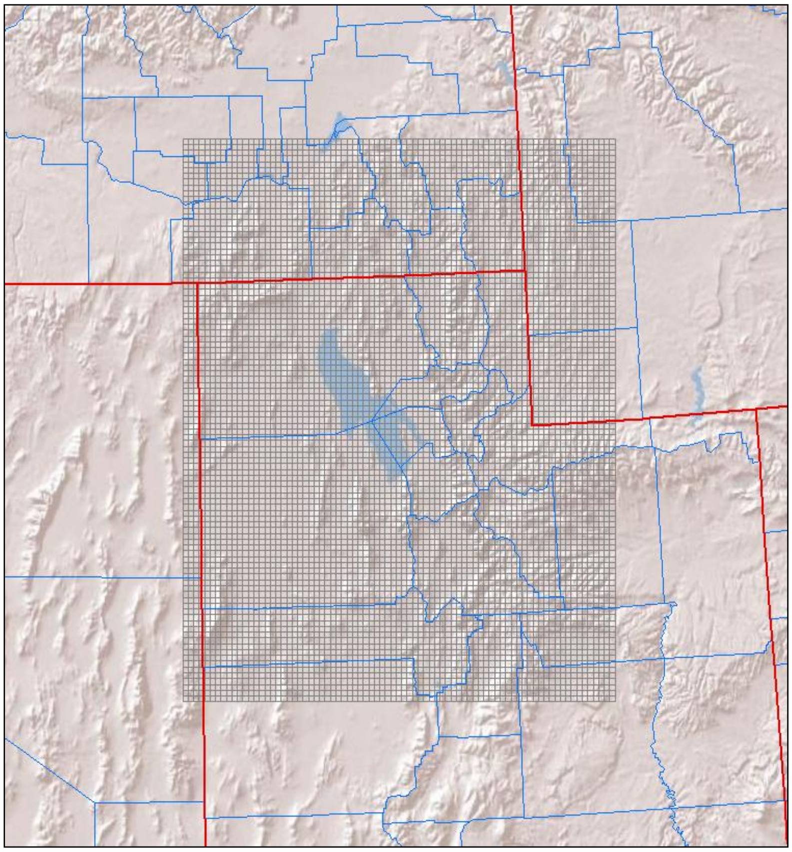


Figure 5.1: Northern Utah photochemical modeling domain.

5.4 Episode Selection

According to EPA's April 2007 "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze" the selection of SIP episodes for modeling should consider the following 4 criteria:

1. Select episodes that represent a variety of meteorological conditions that lead to elevated $PM_{2.5}$.
2. Select episodes during which observed concentrations are close to the baseline design value.
3. Select episodes that have extensive air quality data bases.
4. Select enough episodes such that the model attainment test is based on multiple days at each monitor violating NAAQS.

In general, UDAQ wanted to select episodes with hourly $PM_{2.5}$ concentrations that are reflective of conditions that lead to 24-hour NAAQS exceedances. From a synoptic meteorology point of view, each selected episode features a similar pattern. The typical pattern includes a deep trough over the eastern United States with a building and eastward moving ridge over the western United States. The episodes typically begin as the ridge begins to build eastward, near surface winds weaken, and rapid stabilization due to warm advection and subsidence dominate. As the ridge centers over Utah and subsidence peaks, the atmosphere becomes extremely stable and a subsidence inversion descends towards the surface. During this time, weak insolation, light winds, and cold temperatures promote the development of a persistent cold air pool. Not until the ridge moves eastward or breaks down from north to south is there enough mixing in the atmosphere to completely erode the persistent cold air pool.

From the most recent 5-year period of 2007-2011, UDAQ developed a long list of candidate $PM_{2.5}$ wintertime episodes. Three episodes were selected. An episode was selected from January 2007, an episode from February 2008, and an episode during the winter of 2009-2010 that features multi-event episodes of $PM_{2.5}$ buildup and washout. Further detail of the episodes is below:

- **Episode 1: January 11-20, 2007**

A cold front passed through Utah during the early portion of the episode and brought very cold temperatures and several inches of fresh snow to the Wasatch Front. The trough was quickly followed by a ridge that built north into British Columbia and began expanding east into Utah. This ridge did not fully center itself over Utah, but the associated light winds, cold temperatures, fresh snow, and subsidence inversion produced very stagnant conditions along the Wasatch Front. High temperatures in Salt Lake City throughout the episode were in the high teens to mid-20's Fahrenheit.

Figure 5.2 shows hourly $PM_{2.5}$ concentrations from Utah's 4 $PM_{2.5}$ monitors for January 11-20, 2007. The first 6 to 8 days of this episode are suited for modeling. The episode becomes less suited after January 18 because of the complexities in the meteorological conditions leading to temporary $PM_{2.5}$ reductions.

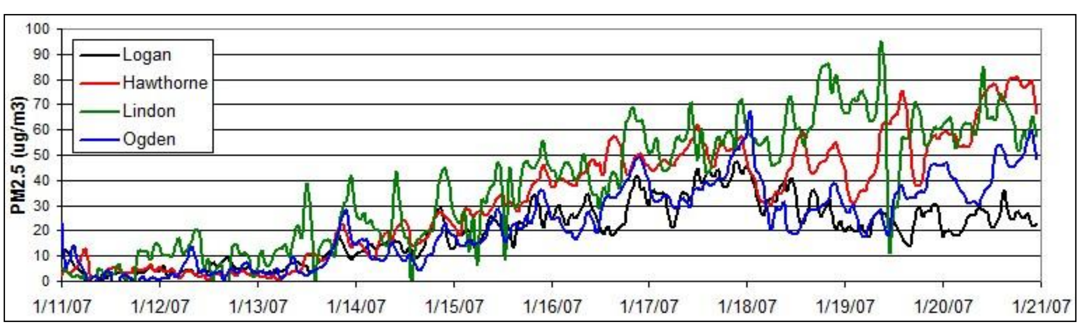


Figure 5.2: Hourly $PM_{2.5}$ concentrations for January 11-20, 2007

- **Episode 2: February 14-18, 2008**

The February 2008 episode features a cold front passage at the start of the episode that brought significant new snow to the Wasatch Front. A ridge began building eastward from the Pacific Coast and centered itself over Utah on Feb 20th. During this time a subsidence inversion lowered significantly from February 16 to February 19. Temperatures during this episode were mild with high temperatures at SLC in the upper 30's and lower 40's Fahrenheit.

The 24-hour average $PM_{2.5}$ exceedances observed during the proposed modeling period of February 14-19, 2008 were not exceptionally high. What makes this episode a good candidate for modeling are the high hourly values and smooth concentration build-up. The first 24-hour exceedances occurred on February 16 and were followed by a rapid increase in $PM_{2.5}$ through the first half of February 17 (Figure 5.3). During the second half of February 17, a subtle meteorological feature produced a mid-morning partial mix-out of particulate matter and forced 24-hour averages to fall. After February 18, the atmosphere began to stabilize again and resulted in even higher $PM_{2.5}$ concentrations during February 20, 21, and 22. Modeling the 14th through the 19th of this episode should successfully capture these dynamics. The smooth gradual build-up of hourly $PM_{2.5}$ is ideal for modeling.

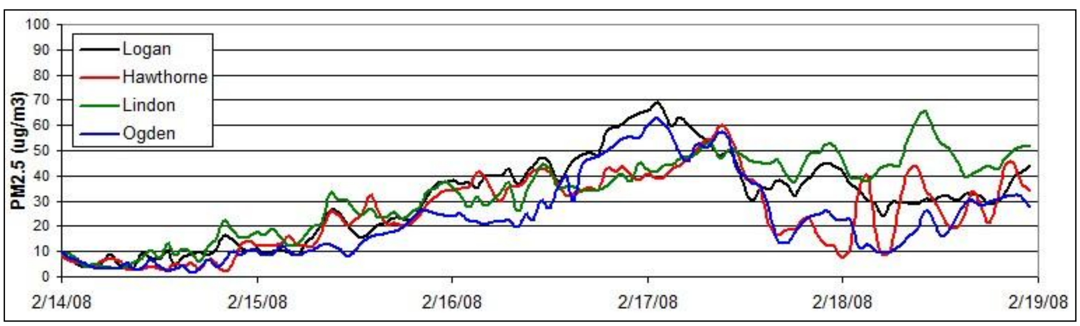


Figure 5.3: Hourly $PM_{2.5}$ concentrations for February 14-19, 2008

- **Episode 3: December 13, 2009 – January 18, 2010**

The third episode that was selected is more similar to a "season" than a single $PM_{2.5}$ episode (Figure 5.4). During the winter of 2009 and 2010, Utah was dominated by a semi-permanent ridge of high pressure that prevented strong storms from crossing Utah. This 35 day period was characterized by 4 to 5 individual $PM_{2.5}$ episodes each followed by a partial $PM_{2.5}$ mix out when a weak weather system passed through the ridge. The long length of the episode and repetitive $PM_{2.5}$ build-up and mix-out cycles makes it ideal for evaluating model strengths and weaknesses and $PM_{2.5}$ control strategies.

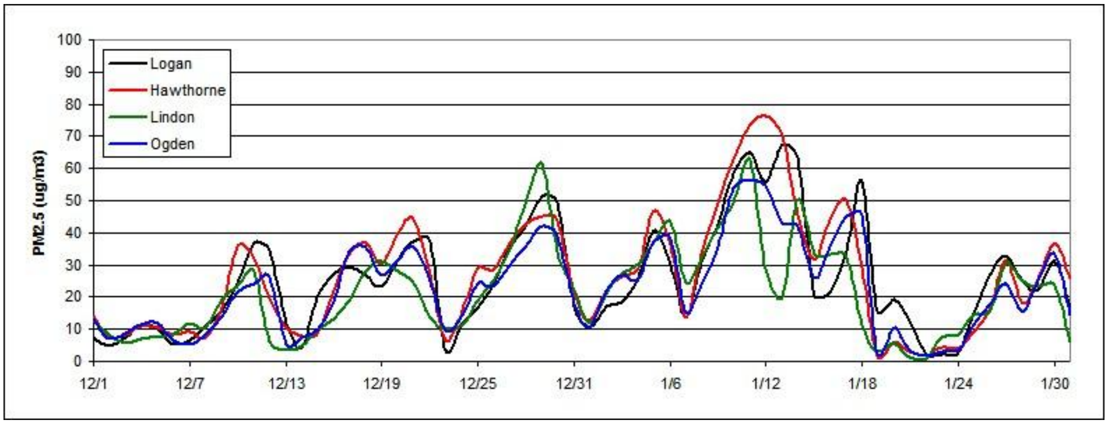


Figure 5.4: 24-hour average $PM_{2.5}$ concentrations for December-January, 2009-10.

5.5 Meteorological Data

Meteorological inputs were derived using the Weather Research and Forecasting (WRF), Advanced Research WRF (WRF-ARW) model version 3.2. WRF contains separate modules to compute different physical processes such as surface energy budgets and soil interactions, turbulence, cloud microphysics, and atmospheric radiation. Within WRF, the user has many options for selecting the different schemes for each type of physical process. There is also a WRF Preprocessing System (WPS) that generates the initial and boundary conditions used by WRF, based on topographic datasets, land use information, and larger-scale atmospheric and oceanic models.

Model performance of WRF was assessed against observations at sites maintained by the Utah Air Monitoring Center. A summary of the performance evaluation results for WRF are presented below:

- The biggest issue with meteorological performance is the existence of a warm bias in surface temperatures during high $PM_{2.5}$ episodes. This warm bias is a common trait of WRF modeling during Utah wintertime inversions.
- WRF does a good job of replicating the light wind speeds (< 5 mph) that occur during high $PM_{2.5}$ episodes.
- WRF is able to simulate the diurnal wind flows common during high $PM_{2.5}$ episodes. WRF captures the overnight downslope and daytime upslope wind flow that occurs in Utah valley basins.
- WRF has reasonable ability to replicate the vertical temperature structure of the boundary layer (i.e., the temperature inversion), although it is difficult for WRF to reproduce the inversion when the inversion is shallow and strong (i.e., an 8 degree temperature increase over 100 vertical meters).

5.6 Photochemical Model Performance Evaluation

The model performance evaluation focused on the magnitude, spatial pattern, and temporal variation of modeled and measured concentrations. This exercise was intended to assess whether, and to what degree, confidence in the model is warranted (and to assess whether model improvements are necessary).

CMAQ model performance was assessed with observed air quality datasets at UDAQ-maintained air monitoring sites (Figure 5.5). Measurements of observed $PM_{2.5}$ concentrations along with gaseous precursors of secondary particulate (e.g., NO_x, ozone) and carbon monoxide are made throughout winter at most of the locations in Figure 5.5. $PM_{2.5}$ speciation performance was assessed using the three Speciation Monitoring Network Sites (STN) located at the Hawthorne site in Salt Lake City, the Bountiful site in Davis County, and the Lindon site in Utah County.

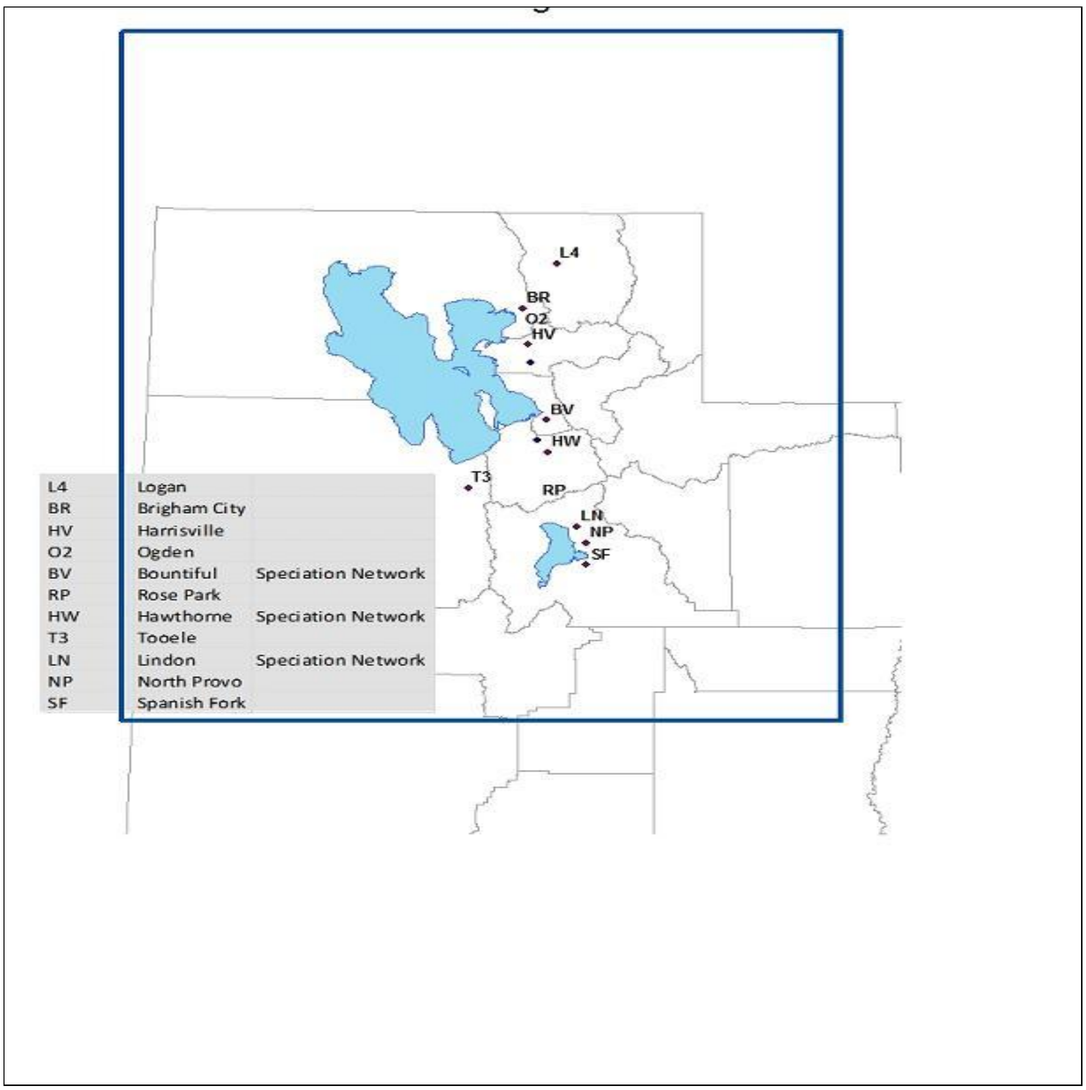


Figure 5.5: UDAQ monitoring network and model domain extent.

A spatial plot is provided for modeled 24-hr $PM_{2.5}$ for 2010 January 03 in Figure 5.6. The spatial plot shows the model does a reasonable job reproducing the high $PM_{2.5}$ values, and keeping those high values confined in the valley locations where emissions occur.

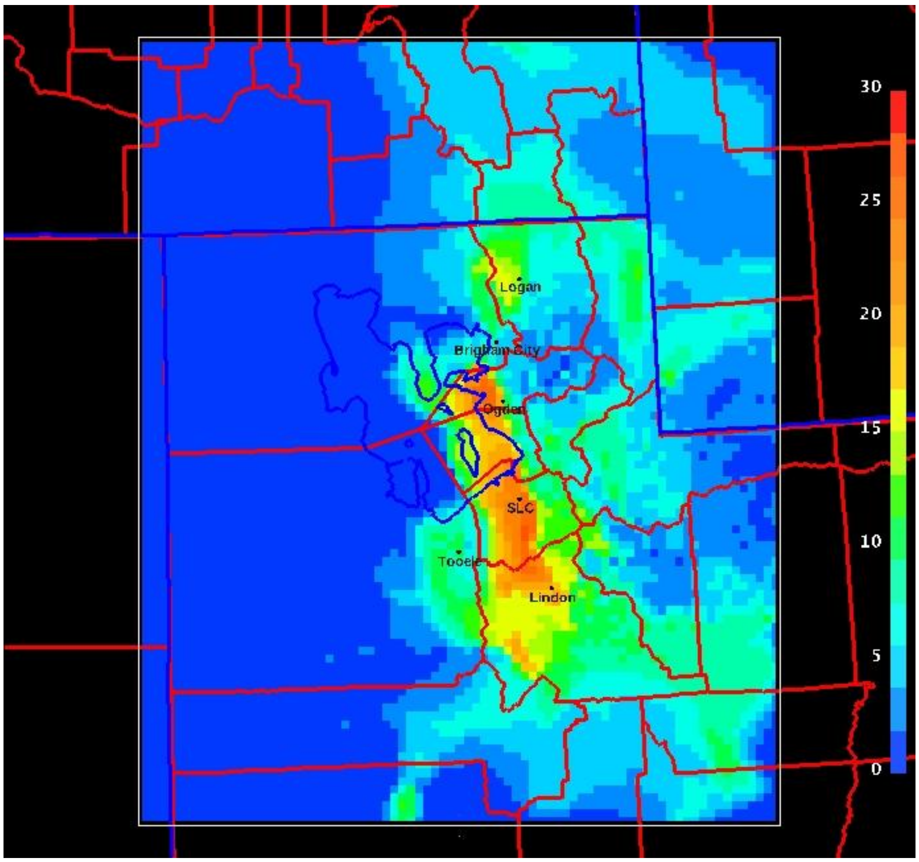


Figure 5.6: Spatial plot of CMAQ modeled 24-hr $PM_{2.5}$ ($\mu g/m^3$) for 2010 Jan. 03.

Time series of 24-hr $PM_{2.5}$ concentrations for the 13 Dec. 2009 – 15 Jan. 2010 modeling period are shown in Figs. 5.7 – 5.9 at the Hawthorne site in Salt Lake City (Fig. 5.7), the Ogden site in Weber County (Fig 5.8), and the Lindon site in Utah County (Fig. 5.9). For the most part, CMAQ replicates the buildup and washout of each individual episode. While CMAQ builds 24-hr $PM_{2.5}$ concentrations during the 08 Jan. – 14 Jan. 2010 episode, it was not able to produce the > 60 $\mu g/m^3$ concentrations observed at the monitoring locations.

It is often seen that CMAQ "washes" out the $PM_{2.5}$ episode a day or two earlier than that seen in the observations. For example, on the day 21 Dec. 2009, the concentration of $PM_{2.5}$ continues to build while CMAQ has already cleaned the valley basins of high $PM_{2.5}$ concentrations. At these times, the observed cold pool that holds the $PM_{2.5}$ is often very shallow and winds just above this cold pool are southerly and strong before the approaching cold front. This situation is very difficult for a meteorological and photochemical model to reproduce. An example of this situation is shown in Fig. 5.10, where the lowest part of the Salt Lake Valley is still under a very shallow stable cold pool, yet higher elevations of the valley have already been cleared of the high $PM_{2.5}$ concentrations.

During the 24 – 30 Dec. 2009 episode, a weak meteorological disturbance brushes through the northernmost portion of Utah. It is noticeable in the observations at the Ogden monitor at 25 Dec. as $PM_{2.5}$ concentrations drop on this day before resuming an increase through Dec. 30. The meteorological model and thus CMAQ correctly pick up this disturbance, but completely clears out the building $PM_{2.5}$; and thus performance suffers at the most northern Utah monitors (e.g. Ogden). The monitors to the south (Hawthorne, Lindon) are not influence by this disturbance and building of $PM_{2.5}$ is replicated by CMAQ. This highlights another challenge of modeling $PM_{2.5}$ episodes in Utah. Often during cold pool events, weak disturbances will pass through Utah that will de-stabilize the valley inversion and cause a partial clear out of $PM_{2.5}$. However, the $PM_{2.5}$ is not completely cleared out, and after the disturbance exits, the valley inversion strengthens and the $PM_{2.5}$ concentrations continue to build. Typically, CMAQ completely mixes out the valley inversion during these weak disturbances.

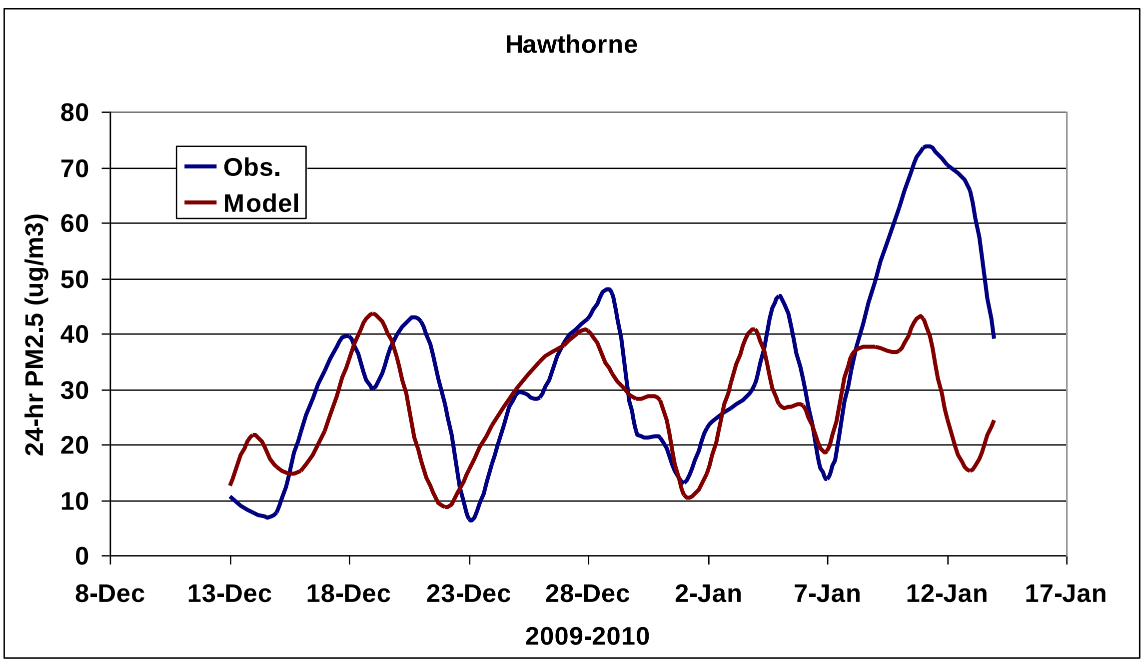


Figure 5.7: 24-hr $PM_{2.5}$ time series (Hawthorne). 24-hr PM2.5 time series. Observed 24-hr PM2.5 (blue trace) and CMAQ modeled 24-hr PM2.5 (red trace).

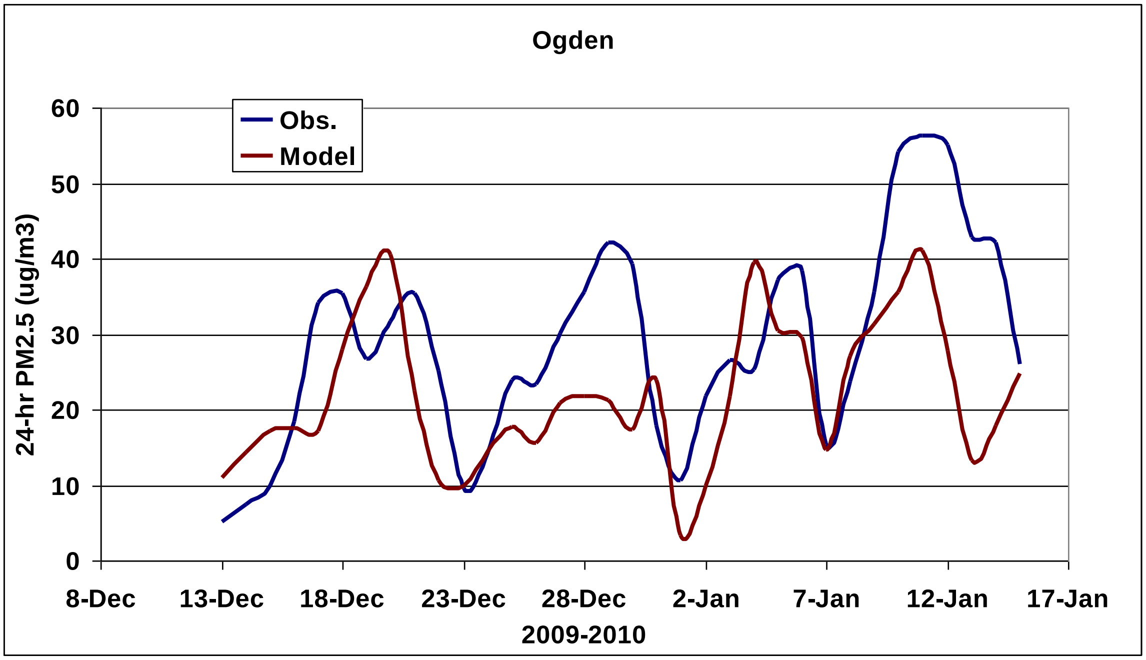


Figure 5.8: 24-hr $PM_{2.5}$ time series (Ogden). 24-hr PM2.5 time series. Observed 24-hr PM2.5 (blue trace) and CMAQ modeled 24-hr PM2.5 (red trace).

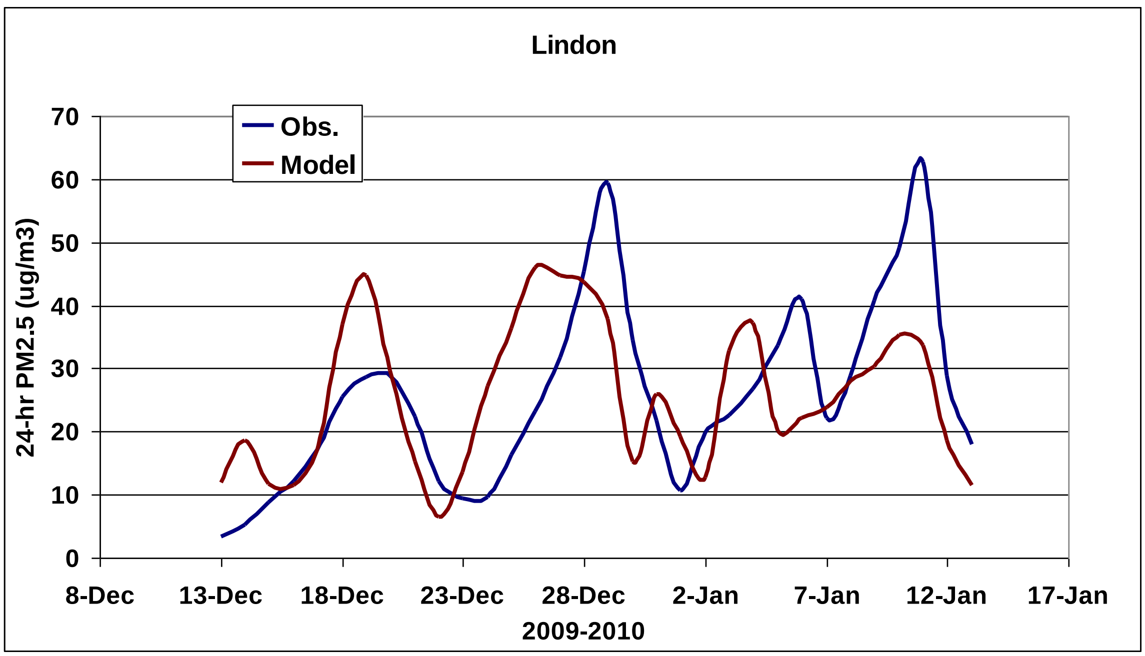


Figure 5.9: 24-hr $PM_{2.5}$ time series (Lindon). 24-hr PM2.5 time series. Observed 24-hr PM2.5 (blue trace) and CMAQ modeled 24-hr PM2.5 (red trace).

Figure 5.10: An example of the Salt Lake Valley at the end of a high $PM_{2.5}$ episode. The lowest elevations of the Salt Lake Valley are still experiencing an inversion and elevated $PM_{2.5}$ concentrations while the $PM_{2.5}$ has been 'cleared out' throughout the rest of the valley. These 'end of episode' clear out periods are difficult to replicate in the photochemical model.

Generally, the performance of CMAQ to replicate the buildup and clear out of $PM_{2.5}$ is good. However, it is important to verify that CMAQ is replicating the components of $PM_{2.5}$ concentrations. $PM_{2.5}$ simulated and observed speciation is shown at the 3 STN sites in Figures 5.11 – 5.13. The observed speciation is constructed using days in which the STN filter 24-hr $PM_{2.5}$ concentration was > 25 $\mu g/m^3$. For the 2009-2010 modeling period, the observed speciation pie charts were created using 10 filter days at Hawthorne, 9 days at Lindon, and 8 days at Bountiful. The speciation of this small dataset appears similar to a comparison of a larger dataset of STN filter speciated data from 2005-2010 for high wintertime $PM_{2.5}$ days (see Figure 3.2 for one of these at Hawthorne).

The simulated speciation is constructed using modeling days that produced 24-hr $PM_{2.5}$ concentrations > 25 $\mu g/m^3$. Using this criterion, the simulated speciation pie chart is created from 18 modeling days for Hawthorne, 16 days at Lindon, and 16 days at Bountiful. At all 3 STN sites, the percentage of simulated nitrate is over-predicted by 5 to 7%. The simulated ammonium percentage is nearly identical to the observed STN speciation. At the Hawthorne site, organic carbon looks to be under-predicted by CMAQ with a percentage of $PM_{2.5}$ at 12% and an observed organic carbon at 21%. This discrepancy in organic carbon is not apparent at the Bountiful and Lindon site.

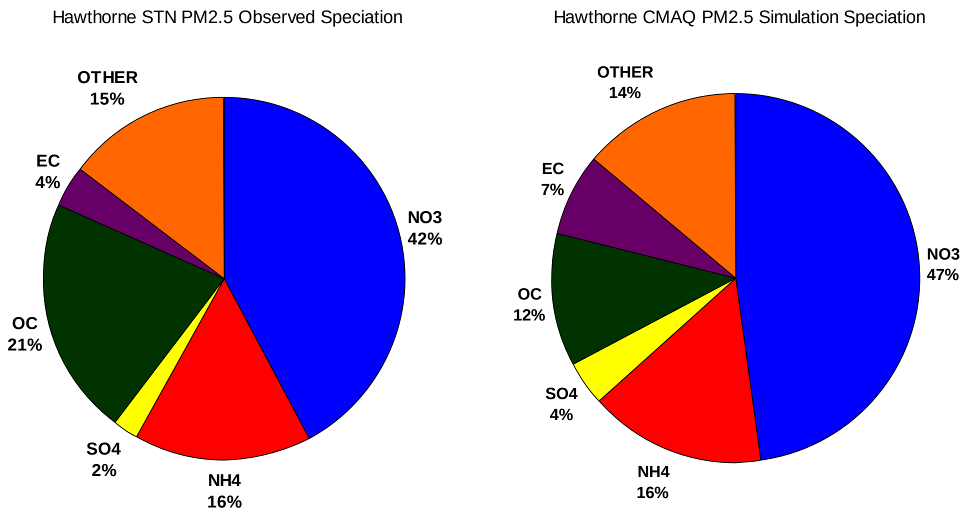


Figure 5.11: The composition of observed and model simulated average 24-hr $PM_{2.5}$ concentrations averaged over days when an observed and modeled day had 24-hr concentrations > 25 µg/m^3 at the Hawthorne STN site.

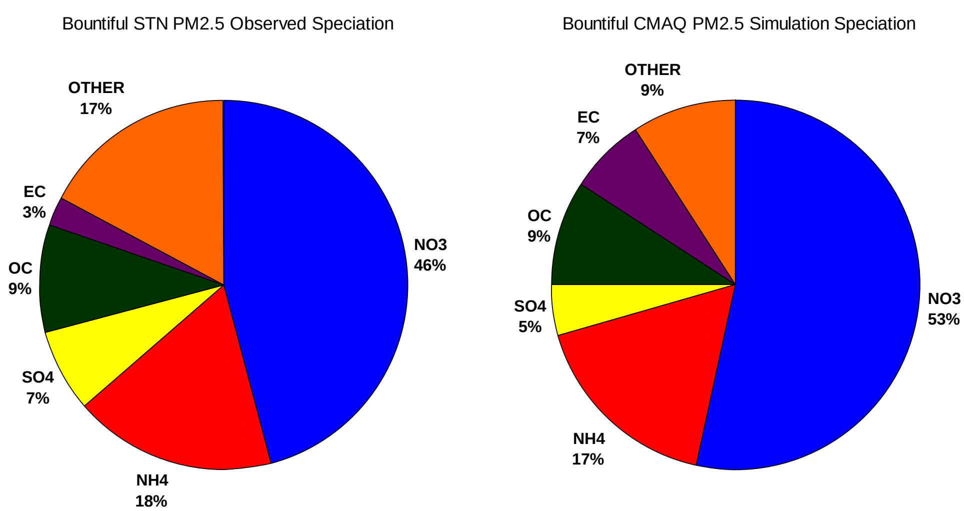


Figure 5.12: The composition of observed and model simulated average 24-hr $PM_{2.5}$ concentrations averaged over days when an observed and modeled day had 24-hr concentrations > 25 µg/m^3 at the Bountiful STN site.

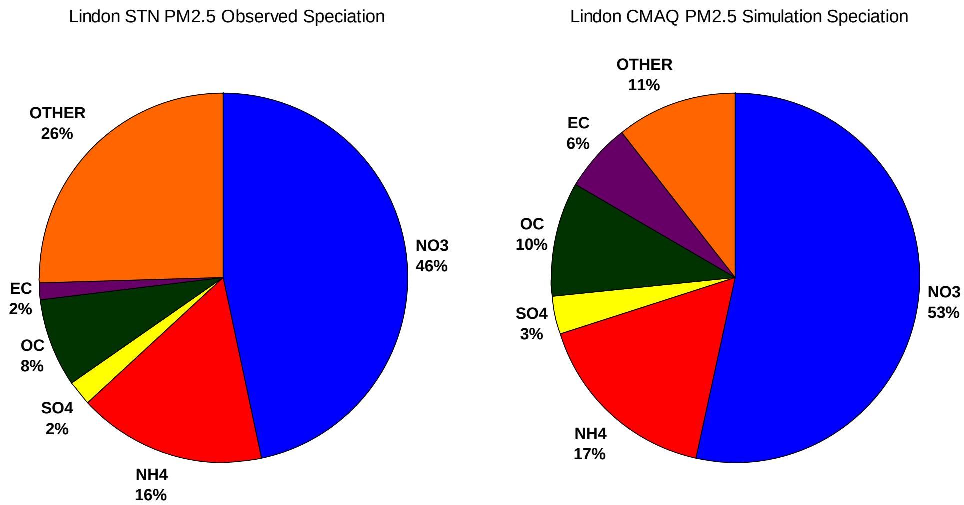


Figure 5.13: The composition of observed and model simulated average 24-hr $PM_{2.5}$ concentrations averaged over days when an observed and modeled day had 24-hr concentrations > 25 µg/m^3 at the Lindon STN site.

5.7 Summary of Model Performance

Model performance for 24-hr $PM_{2.5}$ is good and generally acceptable and can be characterized as follows:

- Good replication of the episodic buildup and clear out of $PM_{2.5}$. Often the model will clear out the simulated $PM_{2.5}$ a day too early at the end of an episode. This clear out time period is difficult to model (i.e., Figure 1.11).
- Good agreement in the magnitude of $PM_{2.5}$, as the model can consistently produce the high concentrations of $PM_{2.5}$ that coincide with observed high concentrations.
- Spatial patterns of modeled 24-hr $PM_{2.5}$, show for the most part, that the $PM_{2.5}$ is being confined in the valley basins, consistent to what is observed.
- Speciation and composition of the modeled $PM_{2.5}$ matches the observed speciation quite well. Modeled and observed nitrate are between 40% and 50% of the $PM_{2.5}$. Ammonium is between 15% and 20% for both modeled and observed $PM_{2.5}$. Organic carbon is underestimated at the Hawthorne location, but is reasonably estimated at the other locations (Bountiful, Lindon).

Several observations should be noted on the implications of these model performance findings on the attainment modeling presented in the following section. First, it has been demonstrated that model performance overall is acceptable and, thus, the model can be used for air quality planning purposes. Second, consistent with EPA guidance, the model is used in a relative sense to project future year values. EPA suggests that this approach “should reduce some of the uncertainty attendant with using absolute model predictions alone." Furthermore, the attainment modeling is supplemented by additional information to provide a weight of evidence determination.

5.8 Modeled Attainment Test

UDAQ will use Model Attainment Test Software (MATS) for the modeled attainment test at grid cells near monitors. MATS is designed to interpolate the species fractions of the PM mass from the Speciation Trends Network (STN) monitors to the FRM monitors. The model also calculates the relative response factor (RRF) for grid cells near each monitor and uses these to calculate a future year design value for these cells.

MATS results for future year modeling is presented in Figure 5.16. The future year design values are presented with and without SIP controls for 2014, 2017, and 2019 (the attainment year). For comparison purposes, the monitored design value is also presented for the base year, 2010.

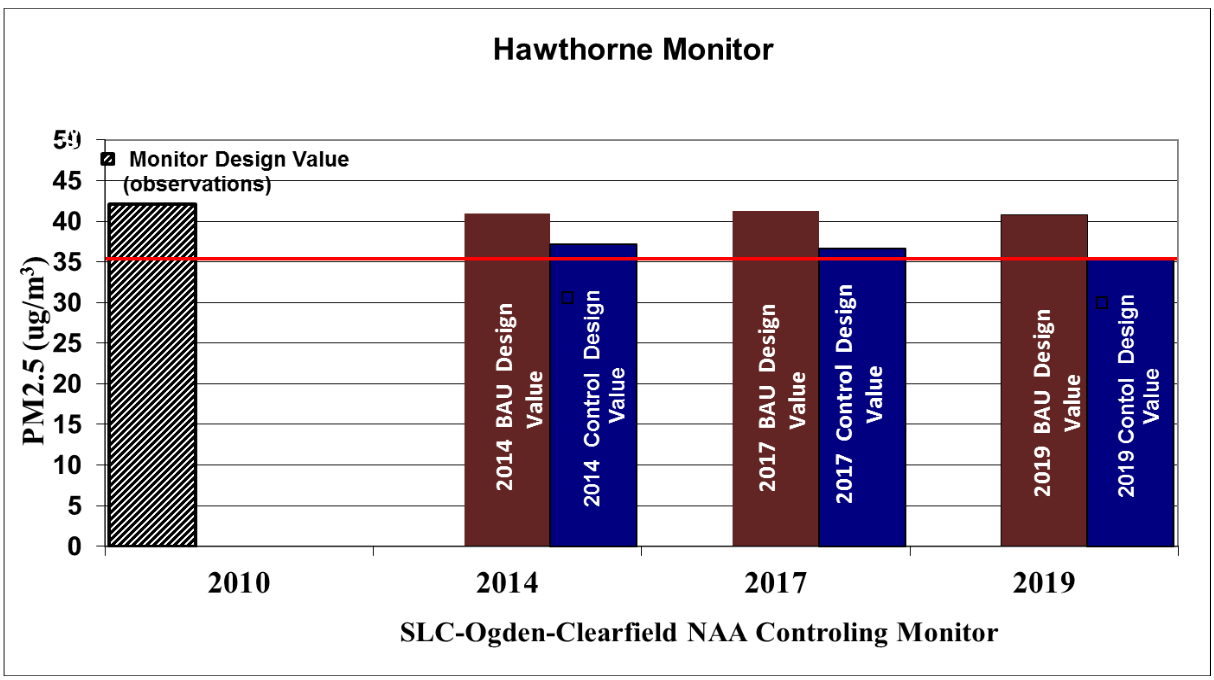


Figure 5.16, Model Results for the Salt Lake City, UT Nonattainment Area

Table 5.3 presents the same information in tabular form, and also includes any additional monitoring locations in the nonattainment area.

	2010	2014		2017		2019	
	Observed	Business-As-Usual	Control Basket	Business-As-Usual	Control Basket	Business-As-Usual	Control Basket
Bountiful	*37*	*34*	*32*	*34*	*32*	*34*	*31*
Brigham City	*40*	*35*	*31*	*35*	*31*	*34*	*30*
Harrisville	*35*	*33*	*30*	*33*	*30*	*33*	*29*
Hawthorne	*42*	*41*	*37*	*41*	*37*	*41*	*35*
Magna	*32*	*31*	*28*	*31*	*27*	*31*	*27*
Ogden 2	*38*	*36*	*34*	*36*	*33*	*36*	*32*
Rose Park	*39*	*39*	*34*	*39*	*34*	*39*	*33*
Tooele	*25*	*23*	*20*	*23*	*19*	*23*	*19*

Table 5.3, Modeled Concentrations ($\mu g/m^3$) for the Salt Lake City, UT Nonattainment Area

The "Control Basket" inventory that is presented in Table 5.3 consists of a combination of SIP reductions on point sources and new rules to be implemented that will affect smaller commercial and industrial businesses. All of these changes are detailed in Chapter 6 - Control Measures. Summary tables of the emission inventories that result from the Control Basket reductions are available in the TSD: Section 3 Baseline and Control Strategies.

5.9 Attainment Date

As shown in the modeled attainment test, the emissions reductions achievable in 2014 do not allow for a demonstration that the Salt Lake City, UT nonattainment area can attain the 24-hour $PM_{2.5}$ NAAQS. Rather, additional reductions will be necessary in the time period between 2014 and 2019 in order to attain. Therefore, this plan identifies an attainment date of December 14, 2019, and requests that the Administrator extend the attainment date the full 5 years permissible under Section 172(a)(2) of the Act.

Chapter 6 – CONTROL MEASURES

6.1 Introduction

Attaining the 24-hour NAAQS for $PM_{2.5}$ will require emission controls from directly emitted $PM_{2.5}$ as well as $PM_{2.5}$ plan precursors (SO_2, NO_x and VOC). It will involve emission sources from each of the four sectors identified in the discussion on emission inventories (stationary point sources, area sources, on-road mobile sources and off-road mobile sources). Furthermore, it will entail control measures of two basic types: existing measures; and measures imposed through this SIP.

This chapter summarizes the overall control strategy for the plan. Additional detail concerning individual emission control measures, including the emissions reductions to be expected, is contained in the Technical Support Document.

6.2 Utah Stakeholder Workgroup Efforts

In response to increasing interest in Utah's air quality problems and the need for greater participation in reducing air emissions, the Utah Division of Air Quality (DAQ) created a significant and meaningful role for public participation in the $PM_{2.5}$ SIP development process. The public involvement process was driven by a need for transparency and inclusivity of public health and business interests impacted by air quality issues.

DAQ's measures of success for the public involvement process were:

- Buy-in from public, stakeholders, and elected officials,
- SIP recommendations that are championed and implemented, and ;
- Close working relationship with partner organizations to deliver a unified message.

Measures of success for participants were:

- Having a say in plans that impacted their communities,
- Access to information and time to understand issues and provide input,
- Access to DAQ staff and the SIP development process,
- Meaningful participation in the process, and;
- Transparency of the process.

Public participation centered on creating workgroups with members from each county within the $PM_{2.5}$ nonattainment area—Box Elder, Cache, Davis, Salt Lake, Tooele, Utah, and Weber. More than 100 people from agriculture, academia, environmental groups, state and local elected officials, industry, and the public volunteered to participate. Their participation ensured that the SIP development process would have grassroots-level input about strategies and their impacts on a countywide level.

Workgroup members were engaged in four rounds of meetings created to provide and gather information. After providing a baseline level of knowledge during Meeting One, draft emissions reductions were discussed during Meetings Two and Three, each followed by a survey to capture new ideas and feedback. Responses from the survey, and other feedback received during the process, were used to refine emissions inventories, in some cases significantly, refine mitigation strategies, provide new strategies, and provide ideas for implementation. Meeting Four was an opportunity for workgroup members to introduce the SIP package to the public and talk about the development process before one of several public comment hearings held in the nonattainment counties.

The public participation process was not without challenges. One of the most difficult was providing information that could get a diverse group of stakeholders to understand very complex and technical air quality and emissions reductions issues. Despite the challenges, the process was successful and contributed to a well-rounded and well-vetted SIP package.

6.3 Identification of Measures

In considering the suite of control measures that could be implemented as part of this plan several important principles were applied to expedite the analysis.

Filter data shows that secondary particulate is the portion of mass most responsible for exceedances of the standard on episode days, and specifically shows that ammonium nitrate is the single largest component of that material. In addition, it shows that organic carbon represents the bulk of primary $PM_{2.5}$.

Priority was given to those source categories or pollutants responsible for relatively larger percentages of the emissions leading to exceedances of the $PM_{2.5}$ NAAQS. The emissions inventory compiled to represent base-year conditions was useful in identifying the contributors to these emissions, particularly in their relation to the formation of ammonium nitrate.

At the same time, the air quality modeling shed light on the sensitivity of the airshed in its response to changes in different pollutants. VOC was immediately identified as a significant contributor to elevated $PM_{2.5}$ concentrations, and proved to be more limiting in the overall atmospheric chemistry than NO_x. This pointed the search for viable control strategies toward VOC emissions, and somewhat away from NO_x. It also became apparent that directly emitted $PM_{2.5}$, while a relatively small portion of the overall filter mass, is independent of the non-linear chemical transformation to particulate matter. Therefore, any reduction in $PM_{2.5}$ emissions will directly improve future $PM_{2.5}$ concentrations, and like VOC, made these emissions an attractive target for potential control measures. Subsequent modeling revealed that, as time progressed and the relative concentrations of NO_x and VOC changed, controlling for NO_x would yield more benefit in terms of controlling $PM_{2.5}$.

6.4 Existing Control Measures

The idea of controlling emissions to the airshed is not a new one. Since about 1970 there have been regulations at both the state and federal level to mitigate air contaminants. It follows that the estimates of emissions used in modeled attainment demonstration for this Plan take into account the effectiveness of existing control measures. These measures affect not only the levels of current emissions, but some continue to affect emissions trends as well.

An example of the former would be the effectiveness of an add-on control device at a stationary point source. It is presently effective in controlling emissions, and will continue to be that effective five years from now.

An example of the latter would be a federal rule that affects the manufacture of engines. The engines already sold into the airshed are effective in reducing emissions, but the number of these engines replacing older, higher emitting engines is increasing. Therefore, a rule such as this also affects the trend of emissions for that source category in a positive way.

The effectiveness of any control measure that was in place, and enforceable, at the time this Plan was written has been accounted for in the tabulation of baseline emissions and projected emissions. Other controls that are anticipated but not yet in place do not factor into the attainment demonstration underlying this Plan.

The following paragraphs discuss some of the more important control strategies that are already in place for the four basic sectors of the emissions inventory.

<u>Stationary Point Sources:</u>

Utah's permitting rules require a review of new and modified major stationary sources in nonattainment areas, as is required by Section 173 of the Clean Air Act. Beyond that however, even minor sources and minor modifications to major sources, planning to locate anywhere in the state, are required to undergo a new source review analysis and receive an approval order to construct. Part of this review is an analysis to ensure the application of Best Available Control Technology (BACT). This requirement is ongoing and ensures that Utah's industry is well controlled.

Along the central Wasatch Front, stationary sources were required to reduce emissions at several junctures to address nonattainment issues with SO_2, ozone and PM_{10}.

SIPs for ozone and SO_2 in 1981 affected all of the precursors to secondary particulate. There were SO_2 reductions at the copper smelter and VOC reductions at the refineries. In addition, Control Techniques Guideline documents (CTGs) affecting VOC emissions at a variety of industrial source categories were incorporated into Utah's air quality rules.

In the early 1990s, stationary sources were required to reduce PM_{10}, SO_2, and NO_x to address wintertime PM_{10} nonattainment.

Any of the source-specific emission controls or operating practices that has been required as a result of the forgoing has been reflected in the baseline emissions calculated for the large stationary sources, and therefore evaluated in the modeled attainment demonstration.

<u>Area sources:</u>

Stage 1 vapor control was introduced in Salt Lake and Davis Counties as part of the 1981 ozone SIP. This is a method of collecting VOC vapors, as underground gasoline storage tanks are filled at gas stations, and returning those vapors to a facility where they are collected and recycled. Since that time it has been extended to include the entire state.

Part of the PM_{10} control for Salt Lake and Davis Counties in the early 1990s was a program to curtail woodsmoke emissions during periods of atmospheric stagnation. Woodsmoke is rich in VOC emissions in addition to the particulate matter which is almost entirely within the $PM_{2.5}$ size fraction. In 2006 the woodburning program was extended to include the western half of Weber County as well.

CTGs adopted into Utah's air quality rules to control VOC emissions in Salt Lake and Davis Counties, as part of the 1981 ozone SIP, are also effective in controlling emissions from area sources.

Energy Efficiency

EPA recognizes the benefits of including energy efficiency programs in SIP's as a low cost means of reducing emissions. Two established energy efficiency programs that result in direct emission reductions within the Wasatch Front are already in place.

Questar Gas ThermWise Rebate Programs

Questar started the ThermWise Rebate Programs on January 1, 2007 as a way to promote the use of energy-efficient appliances and practices among its customers. The ThermWise Programs offer rebates to help offset the initial cost of energy-efficient appliances and weatherization. There are also rebates available for energy efficient new construction. The cost of rebates is built into the Questar gas rate. The rebates are vetted by the Utah Public Service Commission's strict "cost-effectiveness" tests. To pass these tests, Questar must prove that the energy cost savings produced by the ThermWise Programs exceeds the cost of the rebates. There is no scheduled end to the ThermWise Programs. According to the Questar program information, the program will remain in place as long as rebates remain cost-effective.

UDAQ calculates area source emissions for natural gas by multiplying emission factors against actual and projected year gas usage data submitted by Questar. In this way, actual realized program reductions are expressed in the past year (baseline) emission inventory. Future investment in energy efficiency is not captured in our projected future gas usage. Continuance of this program will result in future gas emissions that are lower than projected.

Weatherization Assistance Program

The Weatherization Assistance Program helps low-income individuals and families reduce energy costs. Individuals, families, the elderly and the disabled who are making no more than 200 percent of the current federal poverty income level are eligible for help. However, priority is given to the elderly and disabled, households with high-energy consumption, emergency situations and homes with preschool-age children.

The Utah Division of Housing and Community Development administer the program statewide through eight government and nonprofit agencies. Benefits are provided in the form of noncash grants to eligible households to make energy-efficiency improvements to those homes.

The energy efficiency realized from this program is also imbedded within the gas usage data UDAQ receives from Questar.

On-road mobile sources:

The federal motor vehicle control program has been one of the most significant control strategies affecting emissions that lead to $PM_{2.5}$. Since 1968, the program has required newer vehicles to meet ever more stringent emission standards for CO, NO_x, and VOC. Tier 1 standards were established in the early 1990s and were fully implemented by 1997. The Tier 1 emission standards can be found in Table 6.1. The EPA created a voluntary clean car program on January 7, 1998 (63 FR January 7, 1998), which was called the National Low Emission Vehicle (NLEV) program. This program asked auto manufacturers to commit to meet tailpipe standards for light duty vehicles that were more stringent than Tier 1 standards.

EPA Tier 1 Emission Standards for Passenger Cars and Light-Duty Trucks, FTP 75, g/mi

	100,000 miles/10 years[1]					
Category	**THC**	**NMHC**	**CO**	**NO_x[2] diesel**	***NO_x gasoline***	**PM[3]**
Passenger cars	-	0.31	4.2	1.25	*0.6*	0.1
LLDT, LVW <3,750 lbs	0.8	0.31	4.2	1.25	*0.6*	0.1
LLDT, LVW >3,750 lbs	0.8	0.4	5.5	0.97	*0.97*	0.1
HLDT, ALVW <5,750 lbs	0.8	0.46	6.4	0.98	*0.98*	0.1
HLDT, ALVW > 5,750 lbs	0.8	0.56	7.3	1.53	*1.53*	0.12

1 - Useful life 120,000 miles/11 years for all HLDT standards and for THC standards for LDT

2 - More relaxed NO_x limits for diesels applicable to vehicles through 2003 model year

3 - PM standards applicable to diesel vehicles only

Abbreviations:

LVW - loaded vehicle weight (curb weight + 300 lbs)

ALVW - adjusted LVW (the numerical average of the curb weight and the GVWR)

LLDT - light light-duty truck (below 6,000 lbs GVWR)

HLDT - heavy light-duty truck (above 6,000 lbs GVWR)

Table 6.1, Tier 1 Emission Standards

Shortly thereafter, EPA promulgated the Tier 2 program. This program went into effect on April 10, 2000 (65 FR 6698 February 10, 2000) and was phased in between 2004 and 2008. Tier 2 introduced more stringent numerical emission limits compared to the previous program (Tier 1). Tier 2 set a single set of standards for all light duty vehicles. The Tier 2 emission standards are structured into 8 permanent and 3 temporary certification levels of different stringency, called "certification bins," and an average fleet standard for NO_x emissions. Vehicle manufacturers have a choice to certify particular vehicles to any of the available bins. The program also required refiners to reduce gasoline sulfur levels nationwide, which was fully implemented in 2007. The sulfur levels need to be reduced so that Tier 2 vehicles could run correctly and maintain their effectiveness. The EPA estimated that the Tier 2 program will reduce oxides of nitrogen emissions by at least 2,220,000 tons per year nationwide in 2020[1]. Tier 2 has also contributed in reducing VOC and direct PM emissions from light duty vehicles. Tier 2 standards are summarized in Table 6.2 below.

Tier 2 Emission Standards, FTP 75, g/mi

Bin#	Full Useful Life				
	NMOG*	**CO**	**NO_x†**	**PM**	**HCHO**
Temporary Bins					
11 MDPV[c]	0.28	7.3	0.9	0.12	0.032
10[a,b,d]	0.156 (0.230)	4.2 (6.4)	0.6	0.08	0.018 (0.027)
9[a,b,e]	0.090 (0.180)	4.2	0.3	0.06	0.018
Permanent Bins					
8[b]	0.125 (0.156)	4.2	0.2	0.02	0.018
7	0.09	4.2	0.15	0.02	0.018
6	0.09	4.2	0.1	0.01	0.018
5	0.09	4.2	0.07	0.01	0.018
4	0.07	2.1	0.04	0.01	0.011
3	0.055	2.1	0.03	0.01	0.011
2	0.01	2.1	0.02	0.01	0.004
1	0	0	0	0	0

* for diesel fueled vehicle, NMOG (non-methane organic gases) means NMHC (non-methane hydrocarbons)

† average manufacturer fleet NO_x standard is 0.07 g/mi for Tier 2 vehicles

[1] 65 FR 6698 February 10, 2000

a - Bin deleted at end of 2006 model year (2008 for HLDTs)

b - The higher temporary NMOG, CO and HCHO values apply only to HLDTs and MDPVs and expire after 2008

c - An additional temporary bin restricted to MDPVs, expires after model year 2008

d - Optional temporary NMOG standard of 0.280 g/mi (full useful life) applies for qualifying LDT4s and MDPVs only

e - Optional temporary NMOG standard of 0.130 g/mi (full useful life) applies for qualifying LDT2s only

Abbreviations:

LDT2 – light duty trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)

LDT4 – light duty trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)

MDPV – medium duty passenger vehicle

HLDT - heavy light duty truck (above 6,000 lbs GVWR)

Table 6.2, Tier 2 Emission Standards

In addition to the benefits from Tier 2 in the current emissions inventories, the emission projections for this SIP from 2014 through 2019 (and beyond) continue to reflect significant improvements in both VOC and NO_x as older vehicles are replaced with Tier 2 vehicles. This trend may be seen in the inventory projections for on-road mobile sources despite the growth in vehicles and vehicle miles traveled that are factored into the same projections.

Additional on-road mobile source emissions improvement stemmed from federal regulations for heavy-duty diesel vehicles. The Highway Diesel Rule, which aimed at reducing pollution from heavy-duty diesel highway vehicles, was finalized in January 2001. Under the rule, beginning in 2007 (with a phase-in through 2010) heavy-duty diesel highway vehicle emissions were required to be reduced by as much 90 percent with a goal of complete fleet replacement by 2030. In order to enable the updated emission-reduction technologies necessitated by the rule, beginning in 2006 (with a phase-in through 2009) refiners were required to begin producing cleaner-burning ultra-low sulfur diesel fuel. Specifically, the rule required a 97 percent reduction in sulfur content from 500 parts per million (ppm) to 15 ppm. The overall nationwide effect of the rule is estimated to be equivalent to removing the pollution from over 90 percent of trucks and buses when the fleet turnover is completed in 2030.

To supplement the federal motor vehicle control program, Inspection / Maintenance (I/M) Programs were implemented in Salt Lake and Davis Counties in 1984. A program for Weber County was added in 1990. These programs have been effective in identifying vehicles that no longer meet the emission specifications for their respective makes and models, and in ensuring that those vehicles are repaired in a timely manner.

Off-road mobile sources:

Several significant regulatory programs enacted at the federal level will affect emissions from non-road mobile emission sources. This category of emitters includes airplanes, locomotives, hand-held engines, and larger portable engines such as generators and construction equipment. The effectiveness of these controls has been incorporated into the "NONROAD" model UDAQ uses to compile the inventory information for this source category. Thus, the controls have been factored into the projection inventories used in the modeled attainment demonstration.

EPA rules for non-road equipment and vehicles are grouped into various "tiers" in a manner similar to the tiers established for on-road motor vehicles. To date, non-road rules have been promulgated for Tiers 0 through IV, where the oldest equipment group is designated "Tier 0" and the newest equipment, some of which has yet to be manufactured, falls into "Tier IV."

Of note are the following:

<u>Locomotives</u>

Locomotive engine regulation began with Tier 0 standards promulgated in 1998, which apply to model year 2001 engines.

In addition, because of the very long lifetimes of these engines, often up to forty years, Tier 0 standards include remanufacturing standards, which apply to locomotive engines of model years 1973 through 2001.

Subsequent tier standards for line-haul locomotives apply as follows:

Tier	Applicable Model Years
Tier I	2002 - 2004
Tier II	2005 - 2011
Tier III	2012 - 2014
Tier IV	2015 - newer

Yard or "switch" locomotives are regulated under different standards than line-haul locomotives.

Lastly, EPA has promulgated remanufacturing standards for Tier I and 2 locomotive engines to date.

<u>Large Engines</u>

Large non-road engines are usually diesel-powered but include some gasoline-powered equipment.

Large land-based diesel equipment (> 37 kw or 50 hp) used in agricultural, construction and industrial applications are regulated under Tier I rules, which apply to model years 1996 through 2000. Subsequent Tier II through IV rules apply to newer model-year equipment.

Some large non-road engines are gasoline-powered (spark-ignition). These include equipment such as forklifts, some airport ground support equipment, recreational equipment such as ATVs, motorcycles and snowmobiles. These are regulated under various tiers in a manner similar to diesel equipment.

Small Engines

Small engines are generally gasoline-powered (spark-ignition). Equipment includes handheld and larger non-handheld types. Handheld equipment includes lawn and garden power tools such as shrub trimmers, saws and dust blowers. Non-handheld equipment includes equipment such as lawnmowers and lawn tractors. From an emissions standpoint, smaller engine size is offset by the large number of pieces of equipment in use by households and commercial establishments. This equipment is regulated under a tiered structure as well.

Emissions Benefit

Each major revision of the non-road tier standards results in a large reduction of carbon monoxide, hydrocarbons, nitrogen oxides and particulate matter.

For example, the Non-road Diesel Tier II and III Rule, which regulates model-year 2001 through 2008 diesel equipment (> 37 kw or 50 hp) is estimated by EPA, in its Regulatory Announcement for this rule dated August 1998, to decrease NO_x emissions by a million tons per year by 2010, the equivalent of taking 35 million passenger cars off the road.

EPA further estimates, in its Regulatory Announcement dated May 2004, that the Tier IV non-road diesel rule is expected to decrease exhaust emissions per piece of equipment by over 90 percent compared to older equipment.

Low-Sulfur Diesel

Non-road diesel equipment is required to operate on diesel fuel with a sulfur content of no greater than 500 ppm beginning June 1, 2007.

Beginning June 1, 2010, non-road diesel equipment must operate on "ultra-low" sulfur diesel with a sulfur content of no more than 15 ppm.

Locomotives and certain marine engines must operate on ultra-low sulfur diesel by June 1, 2012.

6.5 SIP Controls

Beyond the benefits attributable to the controls already in place, there are new controls identified by this SIP that provide additional benefit toward reaching attainment. A summary of the plan strategy is presented here for each of the emission source sectors.

Overall, within the Salt Lake City – UT nonattainment area, the strategy to reduce emissions results in 22.3 tons per day of combined $PM_{2.5}$, SO_2, NO_x and VOC in 2014, 43.1 tons per day in 2017, and 64.5 tons per day in 2019.

6.6 Reasonably Available Control Measures (RACM/RACT)

Section 172 of the CAA requires that each attainment plan "provide for the implementation of all reasonably available control measures (RACM) as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT)), and shall provide for attainment of the NAAQS."

EPA has interpreted these requirements in the April 25, 2007 Clean Air Fine Particulate Implementation Rule, at 72 FR 20586-20667, and supplemental guidance issued March 2, 2012 (memorandum from Stephen D. Page to Regional Air Directors).

EPA interprets RACM as referring to measures of any type that may be applicable to a wide range of sources (mobile, area, or stationary), whereas RACT refers to measures applicable to stationary sources. Thus, RACT is a type of RACM specifically designed for stationary sources. For both RACT and RACM, potential control measures must be shown to be both technologically and economically feasible.

Pollutants to be addressed by States in establishing RACT and RACM limits in their $PM_{2.5}$ attainment plans will include primary $PM_{2.5}$ as well as any pollutant identified in the plan as a significant contributor to $PM_{2.5}$ formation. For this plan, those pollutants include SO_2, NO_x and VOC.

In general, the combined approach to RACT and RACM includes the following steps: 1) identification of potential measures that are reasonable, 2) modeling to identify the attainment date that is as expeditious as practicable, and 3) selection of RACT and RACM.

EPA's final rule requires States to conduct an analysis to identify RACT for all affected stationary sources. States can thereafter determine that RACT does not include controls that would not otherwise be necessary to meet Reasonable Further Progress (RFP) requirements or to attain the NAAQS as expeditiously as practicable. Any measures that, collectively, would not advance attainment by at least one year are not required for $PM_{2.5}$ RACT/RACM, even if those measures are individually reasonable. RACT may vary in different nonattainment areas based on the reductions needed for attainment as expeditiously as practicable.

Implementation of RACT measures should be as expeditiously as practicable, but in no case should it start later than the beginning of the year before the nominal attainment date. Furthermore, if the attainment date has been extended, it will be necessary to demonstrate RFP. This means that RACT measures need to be phased in to meet certain milestone goals and cannot all be delayed until the final deadline.

This basic process was applied to each of the four basic sectors of the emissions inventory:

Stationary Point sources:

As stated above, RACT refers to measures applicable to stationary sources. Thus, RACT is a type of RACM specifically designed for stationary sources.

Section 172 does not include any specific applicability thresholds to identify the size of sources that States and EPA must consider in the RACT and RACM analysis. In developing the emissions inventories underlying the SIP, the criteria of 40 CFR 51 for air emissions reporting requirements was used to establish a 100 ton per year threshold for identifying a sub-group of stationary point sources that would be evaluated individually. The cut-off was applied to either a sources reported emissions for 2008 or for its potential to emit in a given year. The rest of the point sources were assumed to represent a portion of the overall area source inventory.

Sources meeting the criteria described above were individually evaluated to determine whether their operations would be consistent with RACT.

SIPs for $PM_{2.5}$ must assure that the RACT requirement is met, either through a new RACT determination or a certification that previously required RACT controls (e.g. for another pollutant such as PM_{10}) represent RACT for $PM_{2.5}$.

With respect to prior technology determinations other than RACT, the rule provides that prior BACT and LAER determinations, in many cases but not all, would assure at least RACT level controls. Where a State has determined VOC to be a significant contributor to $PM_{2.5}$, compliance with MACT standards may be considered in VOC RACT determinations. EPA anticipates it will be unlikely that States can do much better than what the MACT controls currently require.

In conducting the analysis, UDAQ found that as a whole the large stationary sources were already operating with a high degree of emission control. It follows that the percentage of SIP related emissions reductions is not large relative to the overall quantity of emissions. As stated before, many of these sources were required to reduce emissions to address nonattainment issues with SO_2, ozone and PM_{10}. Routine permitting in these areas of nonattainment already includes BACT as an ongoing standard of review, even for minor sources and modifications. In order to find additional emission reductions at these sources, UDAQ identified a level of emission control that goes beyond reasonable, or RACT, and achieves the best available control.

Additional information regarding the RACT analysis for each of the sources in the nonattainment area may be found in the Technical Support Document.

For the Salt Lake City, UT nonattainment area, there are 28 stationary point sources that met or meet the criteria of 100 tons per year for $PM_{2.5}$ or any attainment plan precursor. Emissions from these sources, for the 2010 baseline as well as the projection years 2014, 2017 and 2019 are shown below in Table 6.3. Note that these emissions also include the growth projections that were applied. Information is provided in the TSD regarding the emissions reductions specific to reduction strategies resulting from the SIP.

Typical Winter Incversion Weekday Emissions (tons/day)											
		2010 Baseline (R2)					2014 (R43)				
NA Area	Site Name	PM2_5	NOX	VOC	NH3	SO2	PM2_5	NOX	VOC	NH3	SO2
Salt Lake City - UT Nonattainment Area	ATK Thiokol Promontory	0.13	0.36	0.14	0.00	0.04	0.14	0.39	0.15	0.00	0.04
	Big West Refinery	0.17	0.70	1.28	0.31	1.07	0.17	0.69	1.28	0.31	1.05
	Bountiful City Power	0.00	0.00	0.00		0.00	0.08	0.21	0.05		0.00
	Central Valley Water	0.00	0.03	0.14	0.00	0.00	0.00	0.04	0.03	0.00	0.00
	CER Generation II LLC - WVC	0.02	0.04	0.00		0.00	0.02	0.04	0.00		0.00
	Chemical Lime Company	0.04	0.04	0.00	0.00	0.03	0.05	0.05	0.00	0.00	0.04
	Chevron Refinery	0.50	2.99	0.66	0.03	1.77	0.10	0.95	1.23	0.02	0.07
	Geneva Rock Point of Mountain	0.07	0.27	0.05		0.04	0.08	0.32	0.06		0.04
	Great Salt Lake Minerals - Production Plant	0.13	0.25	0.02	0.00	0.02	0.12	0.37	0.06	0.00	0.02
	Hexcel Corporation Salt Lake Operations	0.05	0.22	0.18	0.08	0.02	0.16	0.32	0.39	0.07	0.09
	Hill Air Force Base Main	0.04	0.52	0.83	0.01	0.01	0.04	0.57	0.83	0.01	0.01
	Holly Refining Marketing	0.15	0.85	0.66	0.06	1.32	0.22	1.09	0.67	0.30	0.31
	Interstate Brick Brick	0.18	0.11	0.01		0.04					
	Kennecott Mine Concentrator	0.65	8.49	0.50	0.00	0.01	0.85	12.13	0.65	0.00	0.01
	Kennecott NC-UPP-Lab-Tailings	0.01	0.02	0.01	0.00	0.00	0.12	0.02	0.01	0.00	0.00
	Kennecott Smelter & Refinery	0.61	0.47	0.03	0.02	3.02	0.80	0.73	0.06	0.02	3.69
	Murray City Power	0.00	0.00	0.00		0.00					
	Nucor Steel	0.16	0.50	0.20	0.01	0.12	0.35	0.93	0.35	0.00	0.81
	Olympia Sales Co.	0.01	0.00	0.07	0.00	0.00	0.00	0.00	0.09	0.00	0.00
	Pacificorp Gadsby	0.07	0.44	0.03	0.07	0.01	0.07	0.44	0.03	0.07	0.01
	Pacificorp Little Mountain	0.02	1.01	0.01		0.01					
	Proctor & Gamble Paper Products Co.	0.10	0.04	0.07		0.00	0.56	0.64	0.63		0.01
	Silver Eagle Refining	0.01	0.25	0.36	0.01	0.00					
	Tesoro Refinery	0.71	1.16	0.81	0.01	2.81	0.28	1.17	1.08	0.01	2.24
	University of Utah	0.02	0.31	0.02	0.01	0.00	0.03	0.25	0.02	0.01	0.00
	Utility Trailer	0.00	0.12	0.22		0.00					
	Vulcraft	0.02	0.02	0.15	0.00	0.00	0.04	0.03	0.20	0.00	0.00
	Wasatch Integrated IE	0.02	0.90	0.03	0.04	0.29	0.02	1.12	0.04	0.05	0.36
	Salt Lake City NA Total	**3.89**	**20.14**	**6.48**	**0.64**	**10.64**	**4.31**	**22.52**	**7.93**	**0.87**	**8.83**

Typical Winter Incversion Weekday Emissions (tons/day)											
		2017 (R2)					2019 (R57)				
NA Area	Site Name	PM2_5	NOX	VOC	NH3	SO2	PM2_5	NOX	VOC	NH3	SO2
Salt Lake City - UT	ATK Thiokol Promontory	0.15	0.36	0.15	0.00	0.05	0.15	0.37	0.16	0.00	0.05
	Big West Refinery	0.17	0.69	1.28	0.31	1.05	0.09	0.62	1.26	0.31	0.39
	Bountiful City Power	0.08	0.21	0.05		0.00	0.08	0.21	0.05		0.00
	Central Valley Water	0.00	0.04	0.03	0.00	0.00	0.00	0.04	0.03	0.00	0.00
	CER Generation II LLC - WVC	0.02	0.04	0.00		0.00	0.02	0.04	0.00		0.00
	Chemical Lime Company	0.05	0.06	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.05
	Chevron Refinery	0.10	0.95	1.23	0.02	0.07	0.10	2.27	1.23	0.02	1.09
	Geneva Rock Point of Mountain	0.08	0.34	0.06		0.05	0.08	0.34	0.06		0.05
	Great Salt Lake Minerals - Production Plant	0.13	0.33	0.06	0.00	0.03	0.14	0.35	0.07	0.00	0.03
	Hexcel Corporation Salt Lake Operations	0.16	0.48	0.42	0.08	0.16	0.16	0.30	0.47	0.10	0.09
	Hill Air Force Base Main	0.04	0.61	0.88	0.01	0.01	0.04	0.65	0.96	0.01	0.01
	Holly Refining Marketing	0.22	1.09	0.67	0.30	0.31	0.13	0.93	0.70	0.65	0.31
	Interstate Brick Brick										
	Kennecott Mine Concentrator	0.85	12.13	0.65	0.00	0.01	0.90	14.33	0.78	0.01	0.02
	Kennecott NC-UPP-Lab-Tailings	0.30	0.20	0.07	0.00	0.03	0.30	0.20	0.07	0.00	0.03
	Kennecott Smelter & Refinery	0.89	0.82	0.07	0.03	4.09	0.96	0.88	0.08	0.03	4.47
	Murray City Power										
	Nucor Steel	0.37	1.01	0.37	0.00	0.87	0.40	1.08	0.40	0.00	0.94
	Olympia Sales Co.	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.11	0.00	0.00
	Pacificorp Gadsby	0.07	0.40	0.03	0.07	0.01	0.07	0.40	0.03	0.07	0.01
	Pacificorp Little Mountain										
	Proctor & Gamble Paper Products Co.	0.61	0.71	0.69		0.01	0.66	0.76	0.75		0.01
	Silver Eagle Refining										
	Tesoro Refinery	0.28	1.17	1.08	0.01	2.24	0.27	0.82	1.01	0.01	0.82
	University of Utah	0.03	0.21	0.02	0.01	0.00	0.03	0.17	0.02	0.01	0.00
	Utility Trailer										
	Vulcraft	0.05	0.03	0.25	0.00	0.00	0.05	0.04	1.13	0.00	0.00
	Wasatch Integrated IE	0.03	1.23	0.05	0.05	0.40	0.03	0.96	0.05	0.06	0.43
	Salt Lake City NA Total	**4.68**	**23.12**	**8.22**	**0.90**	**9.45**	**4.72**	**25.82**	**9.43**	**1.28**	**8.79**

Table 6.3, Point Source Emissions; Baseline and Projections with Growth and Control

Area sources:

As part of the RACT analysis for area sources, consideration was given to a broad list of source categories. Table 6.4 identifies these categories as well as the pollutant(s) likely to be controlled, and provides some remarks as to whether a control strategy was ultimately pursued. In considering what source categories might be considered, Utah made use of EPA recommendations as well as control strategies from other states. DAQ evaluated each strategy for technical feasibility as part of the RACT analysis. The screening column in table 6.4 identifies whether or not a strategy was retained for rulemaking or screened out for impracticability.

Table 6.4 Area Source Strategy Screening

Strategy	Constituent(s)	SCREENING STATUS	REMARKS
1. Repeal current surface coating rule, R307-340. Replace this rule with individual rules for each category. New rules include PM2.5 nonattainment areas. New rules update applicability and control limits to most current CTG. Current rule includes, paper, fabric and vinyl, metal furniture, large appliance, magnet wire, flat wood, miscellaneous metal parts and graphic arts.	VOC	Retained	R307-340 previously applied to Davis and Salt Lake counties. R307-340 was withdrawn and re-enacted as separate rules for each existing category. The new rules were expanded to nonattainment areas and updated to the most current RACT based limit(s).
2. New separate surface coating rules for following sources: a. Aerospace b. High performance c. Architectural d. Marine e. Sheet, strip & coil f. Traffic markings g. Plastic parts	VOC	See Remarks Column	Aerospace – retained High performance – screened, regulated under Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Architectural – initially screened, further research indicated that adopting the Ozone Transport Commission model rule is feasible. Marine – screened, only 1.2 tpy Sheet, strip & coil – retained Traffic markings - screened, regulated under FIFRA Plastic parts - retained
3. Agricultural practices using Natural Resources Conservation Service (NRSC) practice standards	VOC, $PM_{2.5}$, ammonia	Screened	The NRCS has already enrolled most farmers in the erodible regions in their program thereby negating the need for rulemaking
4. Consumer products rule regulating VOC content	VOC	Retained	
5. Adhesives and sealant rule	VOC	Retained	
6. Expand current solvent degreasing rule R307-335 to $PM_{2.5}$ nonattainment areas and add a new section on industrial solvent cleaning	VOC	Retained	
7. Automobile refinishing rule	VOC	Retained	
8. Expand wood furniture manufacturing rule to $PM_{2.5}$ nonattainment areas. Update to most current CTG.	VOC	Retained	
9. Lower the no burn cut point for residential use of solid fuel burning devices. Require new sale of EPA certified stoves/fireplaces. Prohibit the sale/resale of noncertified stoves in nonattainment areas.	VOC, $PM_{2.5}$, NO_x, SO_x, ammonia	Retained	
10. Ban new sales of stick type outdoor wood boilers in nonattainment areas.	VOC, $PM_{2.5}$, NO_x, SO_x, ammonia	Retained	
11. Industrial bakery rule	VOC	Initially Retained	Screened out after analysis of public comment, cost benefit analysis does not support rulemaking, high cost-low VOC reduction
12. Chain-driven charbroiler restaurant emission control	VOC, $PM_{2.5}$	Retained	
13. Appliance pilot light phase out	VOC, $PM_{2.5}$, NO_x, SO_x, ammonia	Retained	

Strategy	Constituent(s)	SCREENING STATUS	REMARKS
14. Expand current fugitive dust rule, R307-309 to $PM_{2.5}$ nonattainment areas. Require BMP's for dust plans.	$PM_{2.5}$	Retained	
15. Amend fugitive dust rule to include cattle feed lot	$PM_{2.5}$	Screened	Sizeable feed lots are not located in nonattainment areas
16. Low NO_x burners in commercial, industrial, and institutional boilers	VOC, NO_x	Retained	
17. Chemical additives to manure	VOC, ammonia	Screened	Costly with limited control efficiency. Excess ammonia in inventory that would not be sufficient to be effective
18. Ban testing of back-up generators on red-alert days	VOC, $PM_{2.5}$, NO_x, SO_x	Initially Retained	Screened out after review of public comment, rule implementation was more complicated than anticipated, generators cannot be easily reprogrammed
19. Prohibit use of cutback asphalt	VOC	Screened	Cities and highway administration personnel need stockpile for winter time road repair. Very small inventory.
20. Control limits on aggregate processing operations and asphalt manufacturing	$PM_{2.5}$, NO_x, SO_x	Retained	
21. R307-307 Road Salt and Sanding	PM	Retained	Expand current rule to nonattainment areas

EPA has developed control measure guidance documents called, control techniques guidelines (CTGs) for volatile organic compounds (VOCs). CTGs are used as presumptive RACT for VOCs and are guidance in SIP rulemaking. DAQ has evaluated all VOC CTGs for area sources as part of the SIP process.

As noted above, many CTGs were previously adopted into Utah's air quality rules to address ozone nonattainment in Salt Lake and Davis Counties. In conducting this evaluation, consideration was given to whether an expansion of applicability for an existing CTG into additional counties would provide a benefit for $PM_{2.5}$, and whether a strengthening of existing CTG requirements in Salt Lake and Davis Counties would result in an incremental benefit that was economically feasible. Furthermore, EPA has updated some of its existing CTGs and added some new ones to the list.

As part of this SIP, Utah has identified relevant source categories covered by CTGs, and assembled draft rules, based on these CTGs, for reducing emissions from these categories. These rules will apply to the following source categories:

- Control of Volatile Organic Emissions from Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks
- Control of Volatile Organic Emissions from Solvent Metal Cleaning
- Control of Volatile Organic Emissions from Surface Coating of Insulation of Magnet Wire
- Control of Volatile Organic Emissions from Graphic Arts
- Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations
- Control Techniques Guidelines for Industrial Cleaning Solvents
- Control Techniques Guidelines for Flat Wood Paneling Coatings

- Control Techniques Guidelines for Paper, Film, and Foil Coatings
- Control Techniques Guidelines for Large Appliance Coatings
- Control Techniques Guidelines for Metal Furniture Coatings
- Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings
- Control of Volatile Organic Emissions from Coating Operations at Aerospace Manufacturing and Rework Operations

While most VOC sources are addressed by CTGs, the remaining emission sources must be evaluated by engineering analysis, including an evaluation of rulings by other states including model rules developed by the Ozone Transport Commission. These include VOCs from autobody refinishing, restaurant charbroiling, and phasing out appliance pilot lights.

CTGs for $PM_{2.5}$ emissions sources do not exist. RACT for $PM_{2.5}$ has been established through information from varied EPA and other state SIP sources. A useful source of data is the AP 42 Compilation of Air Pollutant Emission Factors, first published by the US Public Health Service in 1968. In 1972, it was revised and issued as the second edition by the EPA. The emission factor/control information was applied to fugitive dust and mining strategies.

Table 6.5 shows the effectiveness (emissions reductions) of the area source SIP control strategy for the Salt Lake City, UT nonattainment area. Most of these rules become effective by January 1, 2014.

Salt Lake City - UT Nonattainment Area												
	2014 lb/day				2017 lb/day				2019 lb/day			
	NOX	PM2_5	SO2	VOC	NOX	PM2_5	SO2	VOC	NOX	PM2_5	SO2	VOC
Area Source Rules												
R307-302, Solid fuel burning	1,633.5	13,188.8	273.1	16,501.5	2,041.8	16,485.9	341.3	20,627.1	3,480.8	28,162.2	581.3	35,234.9
R307-303, Commercial cooking		380.1		98.1		370.4		95.6		407.0		105.0
R307-309, Fugitive dust		196.0				191.8				255.0		
R307-312, Aggregate processing operations		5.0				4.7				5.0		
R307-335, Degreasing				4,079.0				986.7				4,325.0
R307-342, Adhesives & sealants				2,227.0				2,169.6				2,387.0
R307-343, Wood manufacturing				1,206.0				1,175.9				1,276.0
R307-344, Paper, film & foil coating				1,315.0				1,279.2				1,328.0
R307-345, Fabric & vinyl coating				37.0				1,462.4				1,871.0
R307-346, Metal furniture coating				100.0				97.6				100.0
R307-347, Large appliance coating				3.0				3.4				3.0
R307-348, Magnet wire coating				9.0				9.3				9.0
R307-349, Flat wood panel coating				77.0				74.9				116.0
R307-350 Miscellaneous metal parts coating				2,653.0				2,587.7				2,681.0
machinery				151.0				147.0				159.0
other transportation				234.0				229.3				242.0
Special				4.0				4.1				5.0
R307-351, Graphic arts				1,917.0				1,917.2				2,215.0
R307-352, Metal containers				185.0				182.4				185.0
R307-353, Plastic coating				412.0				304.7				390.0
R307-354, Auto body refinishing				2,618.0				2,553.1				2,766.0
R307-355, Aerospace coatings				463.0				454.4				480.0
R307-356, Appliance pilot light	663.8	3.0	4.2	38.8	3,002.5	13.7	19.2	175.7	2,918.5	13.4	18.6	170.8
R307-357, Consumer products				3,840.0				3,735.6				4,116.0
R307-361, Architectural coatings				8,473.0				18,244.0				9,082.0
TOTAL	**2,297.3**	**13,773.0**	**277.3**	**46,641.5**	**5,044.3**	**17,066.6**	**360.5**	**58,516.9**	**6,399.3**	**28,842.5**	**600.0**	**69,246.6**

Table 6.5, Emissions Reductions from Area Source SIP Controls

On-road mobile sources:

A decentralized, test-and-repair program was evaluated for Box Elder and Tooele counties within the nonattainment area. For the evaluation, all model year 1968 and newer vehicles would be subject to a biennial test except for exempt vehicles. The program would exempt vehicles less than four years old as of January 1 on any given year from an emissions inspection. Year 1996 and newer vehicles would be subject to an On-Board Diagnostics (OBD) inspection. Year 1995 and older vehicles would be subject to a two-speed idle inspection (TSI). Based on this evaluation, this program was not included because it was determined that implementation of such a program would not affect PM 2.5 concentrations at the controlling monitor (Hawthorne) for the Salt Lake-Ogden-Clearfield nonattainment area. Additional information is provided in the Technical Support Document.

Off-road mobile sources:

Beyond the existing controls reflected in the projection-year inventories and the air quality modeling there are no emission controls that would apply to this source category.

Chapter 7 – TRANSPORTATION CONFORMITY

7.1 Introduction

The federal Clean Air Act (CAA) requires that transportation plans and programs within the Salt Lake City, Utah $PM_{2.5}$ nonattainment area conform to the air quality plans in the region prior to being approved by the Wasatch Front Regional Council (WFRC) Metropolitan Planning Organization. Demonstration of transportation conformity is a condition to receive federal funding for transportation activities that are consistent with air quality goals established in the Utah State Implementation Plan (SIP). The CAA regulates air pollutant emissions from mobile sources by establishing motor vehicle emissions budgets in the SIP. Transportation conformity requirements are intended to ensure that transportation activities do not interfere with air quality progress. Conformity applies to on-road mobile source emissions from regional transportation plans (RTPs), transportation improvement programs (TIPs), and projects funded or approved by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA) in areas that do not meet or previously have not met the National Ambient Air Quality Standards (NAAQS) for ozone, carbon monoxide, particulate matter less than 10 micrometers in diameter (PM_{10}), particulate matter 2.5 micrometers in diameter or less ($PM_{2.5}$), or nitrogen dioxide.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFTEA-LU) and section 176(c)(2)(A) of the CAA require that all regionally significant highway and transit projects in air quality nonattainment areas be derived from a “conforming” transportation plan. Section 176(c) of the CAA requires that transportation plans, programs, and projects conform to applicable air quality plans before being approved by an MPO. Conformity to an implementation plan means that proposed activities must not (1) cause or contribute to any new violation of any standard in any area, (2) increase the frequency or severity of any existing violation of any standard in any area, or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The plans and programs produced by the transportation planning process of the WFRC are required to conform to the on-road mobile source emissions budgets established in the SIP. Approval of conformity is determined by the FHWA and FTA.

7.2 Consultation

The Interagency Consultation Team (ICT) is an air quality workgroup in Utah that makes technical and policy recommendations regarding transportation conformity issues related to the SIP development and transportation planning process. Section XII of the SIP established the ICT workgroup and defines the roles and responsibilities of the participating agencies. Members of the ICT workgroup collaborated on a regular basis during the development of the $PM_{2.5}$ SIP. They also meet on a regular basis regarding transportation conformity and air quality issues. The ICT workgroup is comprised of management and technical staff members from the affected agencies associated directly with transportation conformity.

ICT Workgroup Agencies

- Utah Division of Air Quality (UDAQ)
- Metropolitan Planning Organizations MPOs
    - Cache MPO
    - Wasatch Front Regional Council
    - Mountainland Association of Governments
- Utah Department of Transportation (UDOT)
- Utah Local Public Transit Agencies
- Federal Highway Administration (FHWA)
- Federal Transit Administration (FTA)
- U.S. Environmental Protection Agency (EPA)

7.3 Regional Emission Analysis

The regional emissions analysis is the primary component of transportation conformity and is administered by the lead transportation agency located in the EPA designated air quality nonattainment area. In December 2009, EPA designated all of Davis and Salt Lake Counties and parts of Box Elder, Tooele, and Weber as the Salt Lake City, Utah $PM_{2.5}$ nonattainment area. The responsible transportation planning organization for the Utah Salt Lake City nonattainment area is covered the Wasatch Front Regional Council (WFRC).

The motor vehicle emissions budget serves as a regulatory limit for on-road mobile source emissions. Motor vehicle emissions limits are defined in 40 CFR 93.101 as "that portion of the total allowable emissions defined in the submitted or approved control strategy implementation plan revision or maintenance plan for a certain date for the purpose of meeting reasonable further progress milestones or demonstrating attainment or maintenance of the NAAQS, for any criteria pollutant or its precursors, allocated to highway and transit vehicle use and emissions." As a condition to receive federal transportation funding, transportation plans, programs, and projects are required to meet those emission budgets through strategies that increase the efficiency of the transportation system and reduce motor vehicle use.

The conformity test consists of either an interim emissions test or a motor vehicle emissions budgets test. The interim conformity test requirements apply until either EPA has declared the motor vehicle emissions budgets adequate for transportation conformity purposes or until EPA approves the $PM_{2.5}$ SIP.

7.4 Interim $PM_{2.5}$ Conformity Test

The EPA interim conformity test for $PM_{2.5}$ emissions requires that future nitrogen oxides (NO_x) and directly emitted $PM_{2.5}$ emissions from RTPs, TIPs, and projects funded or approved by the FHWA or the FTA not exceed 2008 levels. NO_x emissions are a gaseous $PM_{2.5}$ precursor emissions emitted from vehicle exhaust related emissions. Primary particulate emissions consist of particles emitted from vehicle exhaust (elemental carbon, organic carbon, and SO_4) and brake and tire wear. The interim conformity test requirements apply until EPA has declared the motor vehicle emissions budgets adequate for transportation conformity purposes or until it approves the $PM_{2.5}$ SIP.

7.5 Transportation $PM_{2.5}$ Budget Test Requirements

The WFRC collaborated with the ICT workgroup on interim conformity and SIP related issues prior to receiving the official EPA designation status of nonattainment for $PM_{2.5}$. During the SIP development process the WFRC coordinated with the ICT workgroup and developed $PM_{2.5}$ SIP motor vehicle emissions inventories using the latest planning assumptions and tools for traffic analysis and the EPA approved Motor Vehicle Emission Simulator (MOVES) emissions model. Local MOVES modeling data inputs were cooperatively developed by WFRC and the ICT workgroup using EPA recommended methods where applicable.

7.6 Transportation Conformity $PM_{2.5}$ Components

The transportation conformity requirements found in 40 CFR 93.102 require that the $PM_{2.5}$ SIP include motor vehicle emissions budgets for directly emitted $PM_{2.5}$; motor vehicle emissions from tailpipe, brake and tire wear; and emissions of nitrogen oxide (NO_x), a gaseous $PM_{2.5}$ precursor. Because UDAQ has identified volatile organic compounds (VOCs) as a $PM_{2.5}$ precursor that significantly impact $PM_{2.5}$ concentrations, the SIP will need a VOC motor vehicle emissions budget for transportation conformity purposes. The EPA conformity rule presumes that $PM_{2.5}$ re-entrained road dust does not need to be included in the interim conformity test or have an established motor vehicle emissions budget unless either the State or EPA decides that re-entrained road dust emissions are a significant contributor to the $PM_{2.5}$ nonattainment problem. The UDAQ conducted a re-entrained road dust study that concluded that $PM_{2.5}$ re-entrained road dust emissions are negligible in the Salt Lake City, Utah $PM_{2.5}$ nonattainment area and meet the criteria of 40 CFR 93.102(b)(3). EPA Region 8 reviewed the study and concurred with the UDAQ's findings. A similar analysis was undertaken to address direct $PM_{2.5}$ emissions, but in this case the conclusion was otherwise. Therefore, a motor vehicle emissions budget for direct $PM_{2.5}$ is established in this SIP.

7.7 Transportation Conformity $PM_{2.5}$ Budgets

This plan includes reasonable further progress demonstrations for 2014 and 2017 and attainment of the $PM_{2.5}$ standard is projected by 2019.

In this SIP, the state is establishing transportation conformity motor vehicle emission budgets (MVEB) for NO_x, VOC , and direct $PM_{2.5}$ (elemental carbon, organic carbon, SO_4, brake and tire wear) for 2014, 2017, and 2019. The Transportation Conformity $PM_{2.5}$ budgets emissions estimates for the mobile sources are calculated from the EPA approved Motor Vehicle Emission Simulator Model (EPA MOVES 2010a).

Salt Lake City - UT Non-attainment Area Transportation Conformity Budgets
(tons per average winter week day)

	Direct $PM_{2.5}$	NO_x	VOC
2014	5.01	80.00	47.50
2017	4.55	66.98	40.11
2019	3.71	51.68	30.55

Table 7.1, Emissions Budgets for Transportation Conformity Purposes (EPA MOVES 2010a). Note: VOC emissions do not include refueling spillage and displacement vapor loss. Budgets are rounded to the nearest hundredth ton.

Table 7.2 shows subtotals for VOC refueling and fugitive dust emissions. These emissions are not included in the transportation conformity MVEBs for the Salt Lake City – UT Non-attainment Area. Emissions from Table 7.1 and 7.2 can be summed to equal total VOC and $PM_{2.5}$ emissions that were modeled and reported in Table 4.2.

VOC Refueling and Fugitive Dust Emissions for the Salt Lake City – UT Non-attainment Area
(tons per average winter week day)

	VOC Refueling	Fugitive Dust
2014	2.12	3.50
2017	1.69	3.67
2019	1.31	3.54

Table 7.2. VOC Refueling and Fugitive Dust Emissions for the Salt Lake City - UT Non-attainment Area.

Per section 93.124 of the conformity regulations, for transportation conformity analyses using these budgets in analysis years beyond 2019, a trading mechanism is established to allow future increases in on-road direct $PM_{2.5}$ emissions to be offset by future decreases in plan precursor emissions from on-road mobile sources at appropriate ratios established by the air quality model. Future increases in on-road direct $PM_{2.5}$ emissions may be offset with future decreases in NOx emissions from on-road mobile sources at a NOx:$PM_{2.5}$ ratio of 11.44:1 and/or future decreases in VOC emissions from on-road mobile sources at a VOC:$PM_{2.5}$ ratio of 4.72:1. This trading mechanism will only be used if needed for conformity analyses for years after 2019. To ensure that the trading mechanism does not impact the ability to meet the NOx or VOC budgets, the NOx emission reductions available to supplement the direct $PM_{2.5}$ budget shall only be those remaining after the 2019 NOx budget has been met, and the VOC emissions reductions available to supplement the direct $PM_{2.5}$ budget shall only be those remaining after the 2019 VOC budget has been met. Clear documentation of the calculations used in the trading should be included in the conformity analysis.

Chapter 8 – REASONABLE FURTHER PROGRESS

8.1 Introduction

Clean Air Act Section 172(c)(2) requires that plans for nonattainment areas "shall require reasonable further progress (RFP)." In general terms, the goal of these RFP requirements is for areas to achieve generally linear progress toward attainment, as opposed to deferring implementation of all measures until the end, one year prior to the attainment date identified in the SIP.

For areas with an attainment date of 2014 or earlier the attainment demonstration would also be considered to demonstrate that the area is achieving RFP, and there would be no requirement to submit a separate reasonable further progress plan.

For areas with an attainment date beyond 2014, a State is required to submit an RFP plan along with its attainment demonstration and SIP. These plans must demonstrate that generally linear reductions in emissions will occur by 2014, i.e. that emissions in 2014 will be reduced to the extent represented by a generally linear progression from base year emissions (2010) to attainment-level emissions. For any area that needs an extension of the attainment deadline to 2018 or 2019, the State's RFP plan would also need to demonstrate that generally linear reductions will be achieved in the 2017 emissions year as well. The pollutants to be addressed in the RFP plan are those pollutants that are identified as significant for purposes of control measures in the attainment plan.

8.2 RFP for the Salt Lake City, UT Nonattainment Area

The attainment demonstration for the Salt Lake City, UT $PM_{2.5}$ nonattainment area shows that the 24-hr NAAQS will be achieved, but not until 2019. Therefore, this SIP identifies and proposes an attainment date of December 14, 2019.

As stated above, a State is required to submit an RFP plan along with its attainment demonstration and SIP for areas with an attainment date beyond 2014. Furthermore, the State's RFP plan would also need to include a demonstration for the 2017 emissions year.

The representation of generally linear progress is based on the notion that reductions in emissions will result in commensurate reductions in $PM_{2.5}$ concentrations. Hence, as described in the regulations, the RFP showing is based on emissions. Nevertheless, EPA acknowledges that $PM_{2.5}$ mitigation also involves a number of attainment plan precursors and that the associated chemistry is non-linear. Thus, States are given some flexibility to adopt any combination of controls involving the various pollutants that can be shown to provide equivalent benefits using procedures that EPA is recommending (or, at the State's option, air quality modeling).

The RFP plan must demonstrate that in each applicable milestone year, emissions will be at a level consistent with generally linear progress in reducing emissions between the base year and the attainment year.

The base year for the attainment demonstration underlying this plan is 2010. Therefore, the baseline year inventory for the RFP plan will also be 2010.

In keeping with the notion of linear progress, Subpart Z of 40 CFR 51 (at 51.1009) specifies four quantities to be calculated in the RFP plan. These quantities are:

- Full Implementation Reduction, equals: (baseline inventory) – (attainment inventory)
- Milestone Date Fraction, equals: (milestone year – 2010) / (2019 – 2010)
- Benchmark Emission Reduction, and equals: (Full Imp. Reduction) * (Milestone Date Fraction)
- Benchmark Emission Level equals: (baseline inv.) – (Benchmark Reduction)

Together, these four quantities result in the familiar mathematical equation for a straight line: $y = mx + b$. Without reporting the intermediate results of each of these quantities, Table 8.1 presents this information for emission levels of $PM_{2.5}$ and each of the attainment plan precursors: NO_x, SO_2, and VOC. For milestone years 2014 and 2017, the values representing straight linear progress are reported under the column heading "rfp." The other column for that year represents the projected emissions modeled in the attainment demonstration (labeled "projected").

For the attainment year 2019, the end point to the straight line, there is only one column.

The RFP plan must describe the control measures that provide for meeting the reasonable further progress milestones for the area, the timing of implementation of those measures, and the expected reductions in emissions of direct $PM_{2.5}$ and $PM_{2.5}$ attainment plan precursors. For a discussion of the control measures factored into the attainment demonstration, and hence reflected in the modeled emissions totals (in the "projected" column), see Chapter 6 of the Plan.

Reasonable Further Progress
Salt Lake City, UT PM2.5 Nonattainment Area

***Emissions / Year**	**2010**	**2014**		**2017**		**2019**
		projected	rfp	projected	rfp	
PM2.5	19.6	18.6	18.6	18.4	17.8	17.3
NOx	160.5	140.4	139.2	124.2	123.2	112.5
SO2	12.8	10.9	11.9	11.2	11.3	10.8
VOC	130.0	104.9	110.2	93.6	95.4	85.5
Plan precursors	303.3	256.2	261.4	229.0	229.9	208.9
Total	323.0	274.8	279.9	247.3	247.7	226.2
****Concentration**	42	37	39	37	37	35

* Emissions are presented in tons per average winter day
**Value for 2010 is Baseline design value for the Hawthorne monitor

Table 8.1, Reasonable Further Progress Benchmarks for the Salt Lake City, UT Nonattainment Area

The RFP plan must demonstrate that emissions for the milestone year are at levels roughly equivalent to the benchmark emission levels for direct $PM_{2.5}$ emissions and each $PM_{2.5}$ attainment plan precursor to be addressed in the plan. Table 8.1 shows this to be the case for $PM_{2.5}$, each of the plan precursors, all of the plan precursors, and the total for all of the pollutants.

In addition to the emissions totals, the table also includes the 2010 baseline design value for the controlling monitor (Hawthorne) in the nonattainment area and the predicted $PM_{2.5}$ concentrations for each of the milestones. These concentrations are presented as another metric to establish how much improvement is necessary to meet the 24-hour standard. The RFP rule allows for a generally equivalent improvement in air quality by the milestone year as would be achieved under the benchmark RFP plan, where “equivalence” would make use of the information developed for the attainment plan to assess the relationship between emissions reductions and predicted reductions in $PM_{2.5}$ concentrations. Table 8.1 also shows the predicted $PM_{2.5}$ concentrations to be at or better than linear progress.

Motor Vehicle Emissions: 40 CFR 51.1009 also requires that State shall include in its RFP submittal an inventory of on-road mobile source emissions in the nonattainment area. This requirement is for the purposes of establishing motor vehicle emissions budgets for transportation conformity purposes (as required in 40 CFR Part 93).

Table 8.2 presents emissions totals for on-road mobile sources. These are the same totals that factor into the overall emissions reported in the preceding RFP table. For a more specific discussion of motor vehicle emissions budgets for transportation conformity purposes, see Chapter 7 of this Plan.

Mobile Source Emissions Salt Lake City, UT PM2.5 Nonattainment Area				
*Emissions / Year	2010	2014	2017	2019
**PM2.5	8.6	8.5	8.2	7.3
NOx	99.6	80.0	67.0	51.7
***VOC	62.5	49.6	41.8	31.9
* Emissions are presented in tons per average winter day				
** PM2.5 emissions include: tailpipe PM2.5, SO4, brakewear, tire-wear, and re-entrained road dust				
*** VOC totals include refueling emissions				

Table 8.2, Motor Vehicle Emissions for Purposes of RFP

Chapter 9 – CONTINGENCY MEASURES

9.1 Background

Consistent with section 172(c)(9) of the Act, the State must submit in each attainment plan specific contingency measures to be undertaken if the area fails to make reasonable further progress, or fails to attain the $PM_{2.5}$ NAAQS by its attainment date. The contingency measures must take effect without significant further action by the State or EPA.

Nothing in the statute precludes a State from implementing such measures before they are triggered, but the credit for a contingency measure may not be used in either the attainment or reasonable further progress demonstrations.

The SIP should contain trigger mechanisms for the contingency measures, specify a schedule for implementation, and indicate that the measures will be implemented without further action by the State or by EPA.

The CAA does not include the specific level of emission reductions that must be adopted to meet the contingency measures requirement under section 172(c)(9). Nevertheless, in the preamble to the Clean Air Fine Particulate Rule (see 72 FR 20643) EPA recommends that the "emissions reductions anticipated by the contingency measures should be equal to approximately 1 year's worth of emissions reductions necessary to achieve RFP for the area."

9.2 Contingency Measures and Implementation Schedules for the Nonattainment Area

The following measures have been set aside for contingency purposes:

Woodburning Control – No-burn days are presently called at 35 $\mu g/m^3$. By this time the area is already at the 24-hr health standard, and it is likely that air dispersion is very poor. As part of the control strategy for the SIP, rule R307-302 has been amended to change the no-burn call to 25 $\mu g/m^3$. Credit for this change is included in the modeled attainment demonstration as well as the RFP demonstration. However, R307-302 also includes a mechanism to further revise the no-burn call to only 15 $\mu g/m^3$ should a contingency situation arise. The benefit of this rule is to prevent a buildup of particulate matter due to woodsmoke during periods of poor atmospheric mixing which typically precede exceedances of the 24-hour $PM_{2.5}$ NAAQS. This rule has been adopted, and can take effect immediately if so required.

9.3 Conclusions

Control measures developed to meet increasingly stringent ozone and fine PM standards in Utah's urbanized areas have likewise become increasingly stringent, and still it is a challenge to attain the 2006 $PM_{2.5}$ NAAQS. This leaves little room for additional reductions that can be set aside as contingency measures.

The control strategy analysis summarized in Chapter 6 shows that stationary sources already meet or exceed RACT, and represent at most about 20% of the emissions contributing to excessive $PM_{2.5}$ concentrations during winter. By contrast, area sources and on-road mobile sources contribute most of the emissions, but further emission control in these categories extends beyond the authorities of UDAQ. The most meaningful reductions in future emissions of VOC, the most important of all the attainment plan precursors, will likely result from additional restrictions of VOC in consumer products, and from what will likely result from Tier III of the federal motor vehicle control program.